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WAR MACHINE

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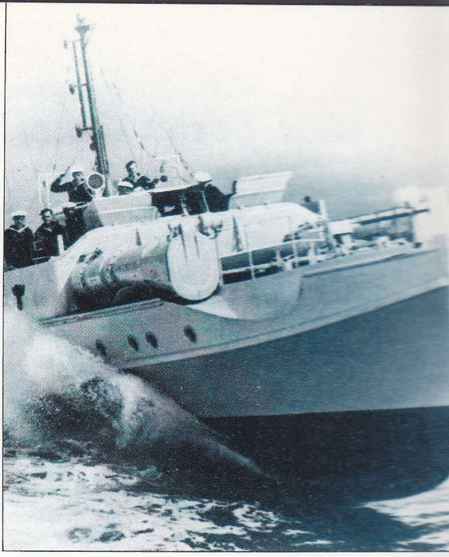
Coastal Craft of World War II

Putting to sea in some of the fastest and most dashing warships of the time, the coastal naval forces saw much fierce fighting in locations as diverse as the North Sea and the 'Slot' in the Solomon Islands. Young, inexperienced crews took their fragile and inflammable craft into action, and often paid the highest price for their courage



Completed in 1939, and seen very early in the war, S22 was one of a class of German torpedo boats known to the Allies as 'E-Boats'. Capable of nearly 40 kts, they were soon to become a deadly menace to coastal shipping.

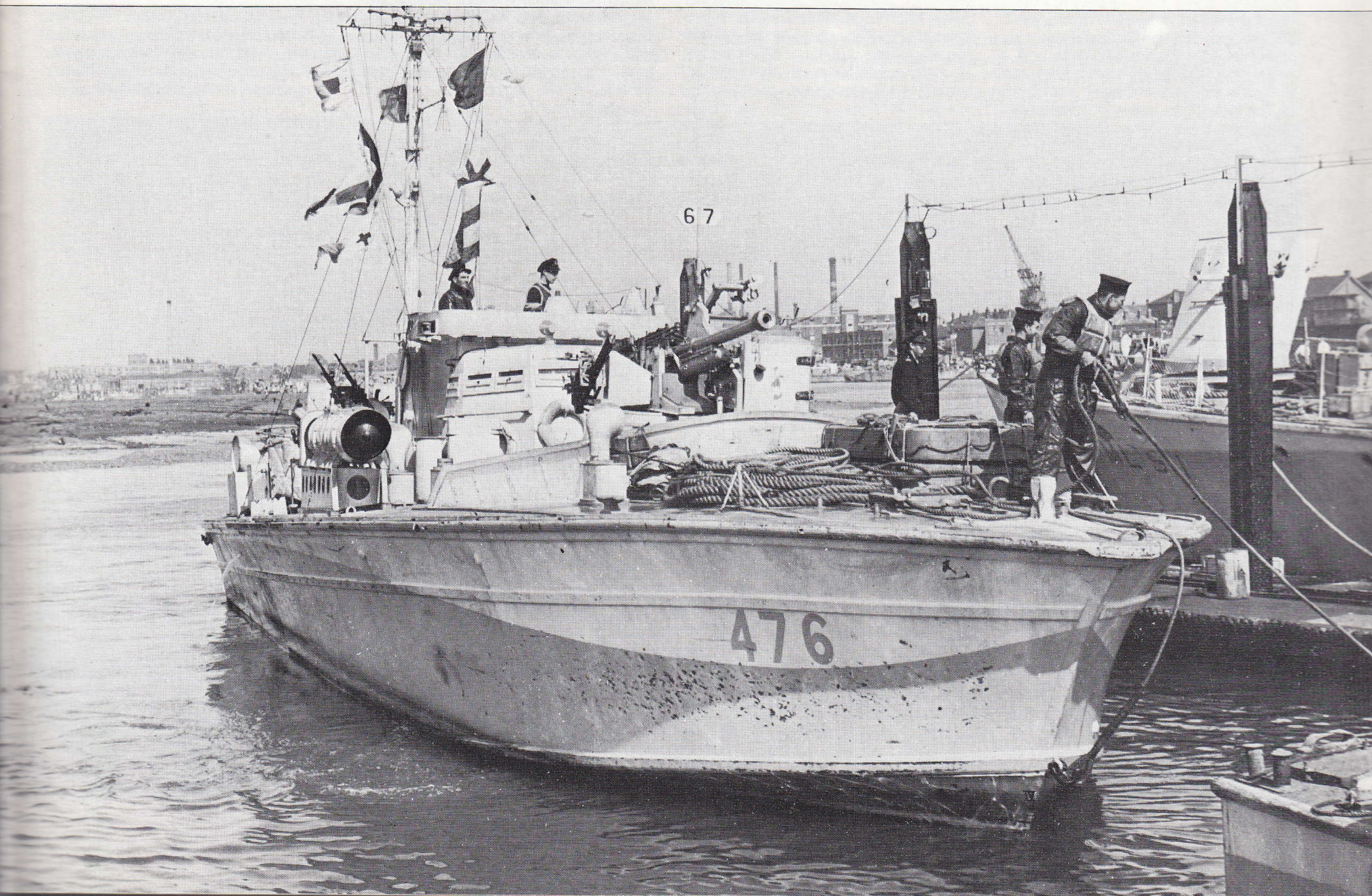
It is in the nature of things that in times of peace 'blue water' fleets tend to devote their limited resources to meeting the problems of ocean warfare; coastal warfare may or may not be required in some emergency in the future and, lacking urgency, inevitably lacks funds. Therefore, it is hardly surprising to discover that between the wars, British expertise was kept alive mainly through the dedication of private firms who were prepared to risk casting effort and funds into the bottomless well of official disinterest. This was doubly fortunate, for the USA had similarly underinvested and owed much to Scott-Paine's British Power Boat Company in the eventual successful story of the PT boat.

Smaller fleets, however, with limited objectives and even more limited funds, tend to look harder at promisingly cost-effective solutions to countering possible hostile sea-powers. The submarine, the raider and mine warfare are three such solutions, and the high-speed coastal craft is a fourth if geography permits. Germany, therefore, put much effort and ingenuity during the 1930s into producing the S-boat, one of her major successes mainly because there had been sufficient development time. Taken out of context, the effect of the S-boat on World War II was not great in a material sense but, measured in psychological and disruptive terms, it was a major nuisance, requiring a large expenditure of scarce war effort to counter.

Likewise, the geography of the central Mediterranean favoured the Italian use of such craft. They had seen major successes from them in World War I and had every intention of keeping abreast of development. Like the Germans they evolved reliable, high-speed machinery which stood them in good stead.

Finally, it was radar-controlled gunfire from the would-be targets by night and air power by day that constrained the torpedo-boat's potential. With the comparatively recent introduction of the surface-to-surface missile the wheel has once again turned, putting a large measure of advantage back with the cheap, high-speed minor warship, the midget with the big clout.

The inter-war years saw little in the way of coastal force development by the Royal Navy. Wartime requirements, however, were soon to give rise to the classic Motor Torpedo Boat, and by 1943 vessels such as MTB 476 were carrying as much gun armament as possible in addition to torpedoes.



USSR

Soviet coastal craft

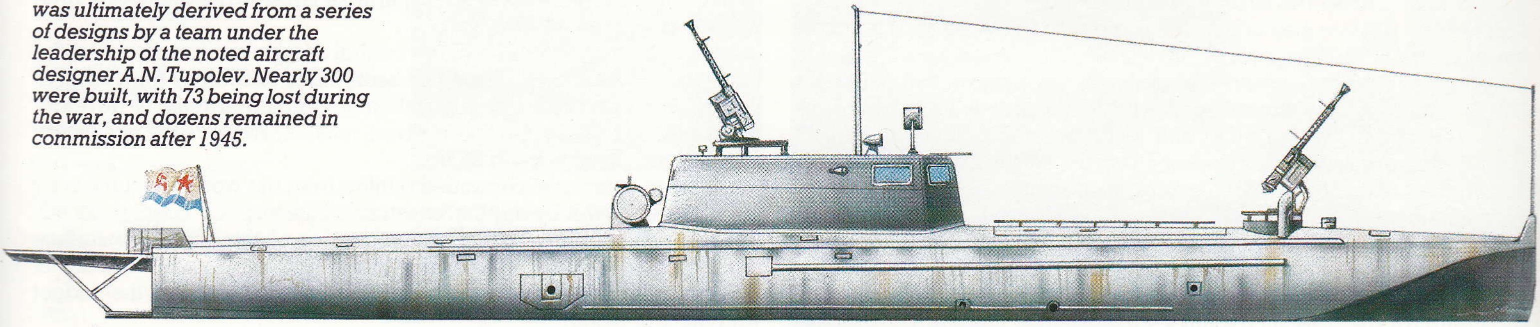
There were strong influences working on the post-revolutionary Soviet navy to develop a powerful and effective force of coastal craft. The fleet itself had been relegated to the status of a means of guaranteeing the seaward flanks of the primary service, the army. These seaward flanks were all of shallow and sheltered water, and distances involved were small. Further, the successful attacks by British CMBs in 1919 had shown the potential of even a few such boats in the right hands, and a couple of unserviceable and damaged Thornycroft 55-footers were available as exemplars. From these beginnings the Soviets had produced by 1928 a reasonably successful 18-m (59.06-ft) craft known as an **S4**. The indifferent Soviet technology of the time required the incorporation of American petrol engines, but the reliability of these and the sound hull shape made for a very high trials speed, approaching 50 kts, though considerably diminished by a load of two 457-mm (18-in) torpedoes or anything but calm conditions. About 60 S4s were built, giving the Soviets considerable experience.

The Tsarist navy had been known for its innovation and readiness to adopt ideas, and this policy continued with the purchase of technology in hull design and machinery from France, Germany and Italy as available. With this as a baseline the Soviets produced a 19-m (62.3-ft) **G5** type, which was still heavily influenced by the British CMB in having a stepped hull and two troughs aft for the stern launching of torpedoes that had been increased in size to 533 mm (21 in). For this craft the Soviets built a successful petrol engine that was tolerably reliable and capable of being upgraded. The fault with the G5 was its early use of aluminium alloy for both shell and frames, so that it was plagued with corrosion problems. For this reason, the follow-on 21.6-m (70.9-ft) **D3** craft were wooden-built, differing further in having side-launching gear for their torpedoes. Numerous G5 and D3 types served during the war, supplemented by over 200 boats from the USA and UK. Also produced in large numbers were armoured craft of many types, comparatively slow but armed with guns and cannon in tank turrets. They proved formidable craft both offshore and up rivers.

Specification

G5 type (late production)
Displacement: 16 tons
Dimensions: length 19.1 m (62.66 ft); beam 3.4 m (11.15 ft); draught 1.0 m (3.28 ft)
Propulsion: two petrol engines delivering 1491 kW (2,000 bhp) to two shafts
Speed: 48 kts
Endurance: about 370 km (230 miles) at 48 kts
Armament: two 533-mm (21-in) torpedoes, and two 12.7-mm (0.5-in) machine-guns
Complement: 7

The extremely fast G5 torpedo boat was ultimately derived from a series of designs by a team under the leadership of the noted aircraft designer A.N. Tupolev. Nearly 300 were built, with 73 being lost during the war, and dozens remained in commission after 1945.



JAPAN

Japanese coastal craft

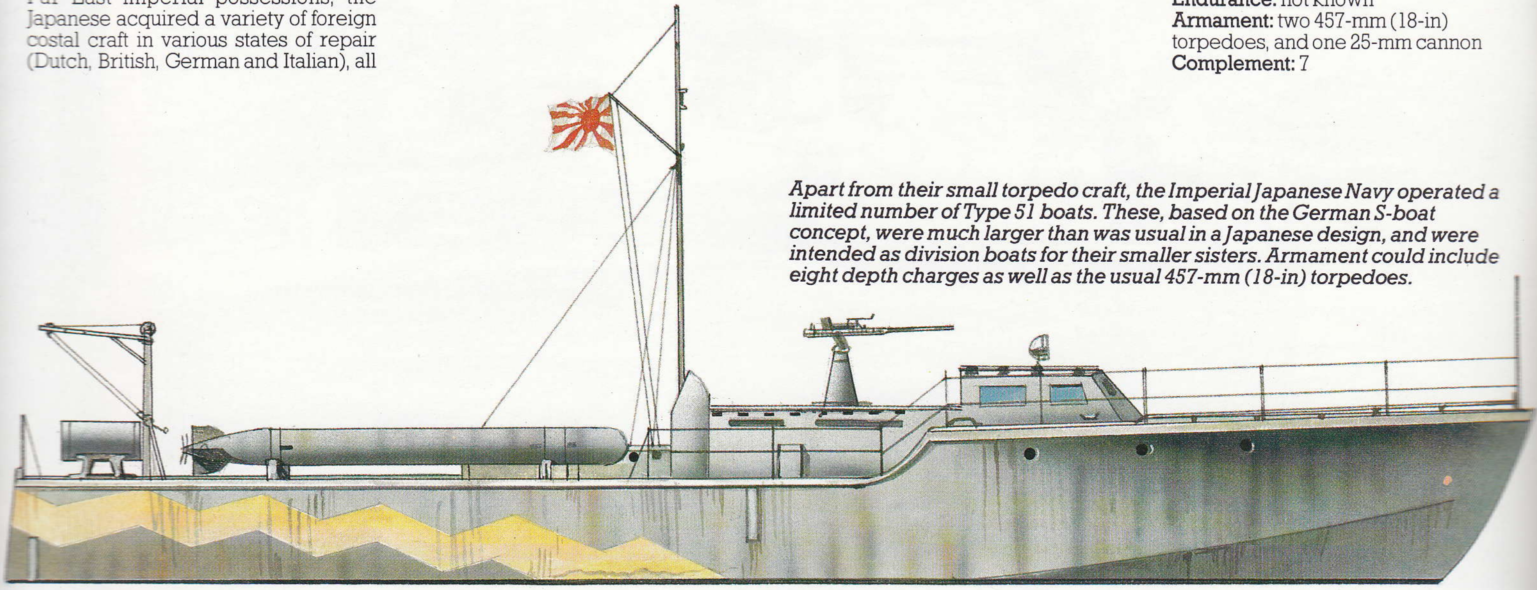
Like the majority of major fleets, the Japanese navy had largely ignored coastal craft between the world wars. As a type it did not fit into ocean warfare and, though the acquisition of a many-islanded empire was accepted strategy, prolonged supply problems in the face of an actively hostile fleet were not. Even as a redeployment of their submarine forces to assault the US Navy's fleet train would have seriously affected that navy's ability to operate, so would a powerful force of Japanese coastal craft have been able both to assist in the garrison supply task and to dispute the American's aim to disrupt it.

With their overrunning of China and Far East imperial possessions, the Japanese acquired a variety of foreign costal craft in various states of repair (Dutch, British, German and Italian), all of which influenced subsequent designs. All were driven by petrol engines, but the Japanese had no capacity to build either these or small high-speed marine diesels in any quantity. Though engines were copied, they were low-powered and always in desperately short supply; as multi-engined layouts were thus out of the question, boats themselves had to be small to attain any speed. The largest Japanese MTBs were, therefore, of only about 18 m (59.06 ft) overall length. All were of hard-chine design to get over the low power problem and this, combined with their lack of length, gave them a poor performance in anything but sheltered waters. Designs were in both wood and steel and were such as to permit construction by undertakings unskilled in boatbuilding. And though aero engines were tried as prime movers, they proved unsatisfactory in a marine environment.

Most numerous of the many Japanese varieties were the 15-m (49.2-ft), single-screwed 49-strong **Type 14** and the 18-m (59.06-ft) twin-screwed **Type 38.** Although the smaller boat could make 33 kts in good conditions, the larger was good for only 27.5 kts and, like others, could be armed as an MGB rather than with two 457-mm (18-in) torpedoes. A 32.4-m (106.3-ft) Lürssen type was also copied as the **Type 51**, but these proved a disappointment and the 18-boat programme was never completed.

Specification

Type 14
Displacement: 15 tons
Dimensions: length 15.0 m (49.2 ft); beam 3.66 m (12.0 ft); beam 0.85 m (2.8 ft)
Propulsion: one petrol engine delivering 686 kW (920 bhp) to one shaft
Speed: 33 kts
Endurance: not known
Armament: two 457-mm (18-in) torpedoes, and one 25-mm cannon
Complement: 7



Apart from their small torpedo craft, the Imperial Japanese Navy operated a limited number of Type 51 boats. These, based on the German S-boat concept, were much larger than was usual in a Japanese design, and were intended as division boats for their smaller sisters. Armament could include eight depth charges as well as the usual 457-mm (18-in) torpedoes.

Fast craft between the wars

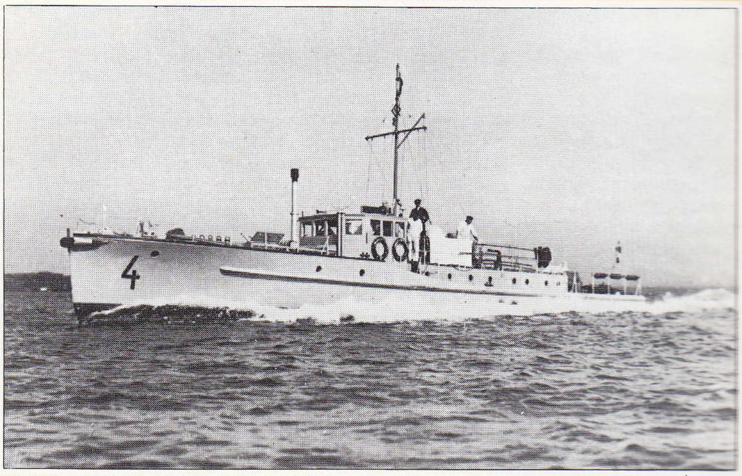
Fast coastal craft proved their worth during World War I, with the Italians achieving the greatest successes, including the sinking of several battleships. In the inter-war years the larger fleets concentrated on major units and ignored coastal craft, but Germany and Italy continued their development, giving them a substantial lead by 1939.

Although the development of the automotive torpedo in the late 19th century promised to realize the dream of the small warship with the killer punch, the need for this 'torpedo boat' to work with and against fleets at sea stimulated too large an increase in size, a trend aggravated by the contemporary technology of steam machinery in displacement hulls. The development of the fast planing hull and the internal combustion engine began the cycle afresh, with progress before 1914 owing much to the commercial prospects of high-speed boating. It was but a small step to mount torpedoes on such craft, and the same specialist yards have tended to remain in the business to this day.

Much effort was put into the production of torpedo-carrying coastal craft during World War I, but only the Italians in the Adriatic and the British in the English Channel and the Baltic ever demonstrated their true potential. Neither employed massed attack, preferring to work singly or in small groups to capitalize on the advantages of agility, surprise and good planning. The Italians were particularly imaginative, evolving craft and tactics to assault an Austro-Hungarian fleet snug in well-defended harbours. The British had to contend with poorer weather conditions and soon learned the value of larger and stronger hulls. They also discovered the threat posed by aircraft and fire from ashore, suffering losses from both despite small size and manoeuvrability. Experience did not turn the British away from hard-chine designs; they accepted a drop in performance in heavy weather in exchange for the benefit of really high speed in calmer water.

After World War I the British totally lost interest in coastal craft, being occupied with deep-sea imperial matters. The Italians went on initially to be joint front runners with the Germans, who saw in the small torpedo boat a means of constructing useful naval tonnage outside treaty restrictions. Beneath the lax gaze of the regulating authorities they built and evaluated numerous hulls under sporting-club colours and, over a decade, identified what were to be the major S-boat characteristics: displacement hull, wood on light alloy construction, stability reserves for 533-mm (21-in) torpedoes and, finally, the small marine diesel. This type of engine required careful development and, once perfected, remained peculiar to German practice, with foreign navies never producing a satisfactory competitor despite the fire risks associated with petrol engines, for which they treated effect rather than cause by introducing self-sealing tanks and improved fire-extinguishing systems.

The Italian Isotta-Fraschini was an excellent petrol engine, used widely abroad until 1940; it was probably its very availability that inhibited comparable development elsewhere. During World War I the Italians found the small planing hull adequate for their Adriatic operations. Translated into the open-sea war of 1940-3 it proved unsatisfactory and was dropped in favour of a German type of round-bilge form.



Seen in the early 1930s, R4 was built as a motor minesweeper, but her size allowed the fitting of a number of light automatic weapons and hence her employment as a coastal escort. Slower than their S-Boot contemporaries, the R-boats were more akin to the British Motor Launch, or ML.

A considerable increase in efficiency resulted in the abandoning of direct drive for purpose-designed reduction gearboxes and propellers, though transmission problems and structural failures proliferated with small hulls that 'worked' in a seaway. Wood had the necessary resilience and ease of repair when clad onto timber or light alloy frames. All-aluminium alloy hulls corroded disastrously in salt-water conditions. As in the pre-transitional navy, it was found that wooden hulls could not exceed a certain length and, for instance in the British SGBs, steel had to be used. A great British innovation was to abandon traditional boat-building methods for mass production, using prefabricated techniques. Once certain weaknesses had been rectified, this system realized great numbers of craft.

Hard-used fast coastal craft have a short operational life and demand continual attention. Specialized depot ships, or tenders, enabled squadrons to operate successfully 'up-front'. The Americans particularly made great use of them, offering off-duty crews accommodation and facilities while undertaking endless hull and machinery repairs, and servicing armament.

The British hard-chined Coastal Motor Boats of World War I were very fast, but required constant attention to trim in order to get the best performance. 1919 saw them in use in a little-known campaign on the Caspian, during the intervention by the Western powers in Russia.

Fast craft between the wars

It had been assumed between the wars that coastal craft would be needed in an inshore ASW role, a belief that hung on until the British SDBs of the 1950s. In the event, submarines generally operated further offshore and those which were destroyed by small craft were despatched by torpedo while navigating on the surface. Specialist AS boats were, therefore, rapidly re-armed as gunboats, their depth charges removed. It remained the practice, however, for many boats to retain a pair of charges for the deterrence of close pursuit.

Small torpedoes of up to 457-mm (18-in) calibre proved to have insufficient ship-stopping capacity, but the size and weight of two or four 533-mm (21-in) weapons tended to dictate the parameters of the boats themselves, to the extent that the Americans developed a special 'short' version. To save the weight of tubes, dropping gear was introduced, though this left the torpedoes themselves vulnerable to damage. The Germans preferred to retain their two enclosed tubes forward, with a reload for each stowed safely behind a bulwark.

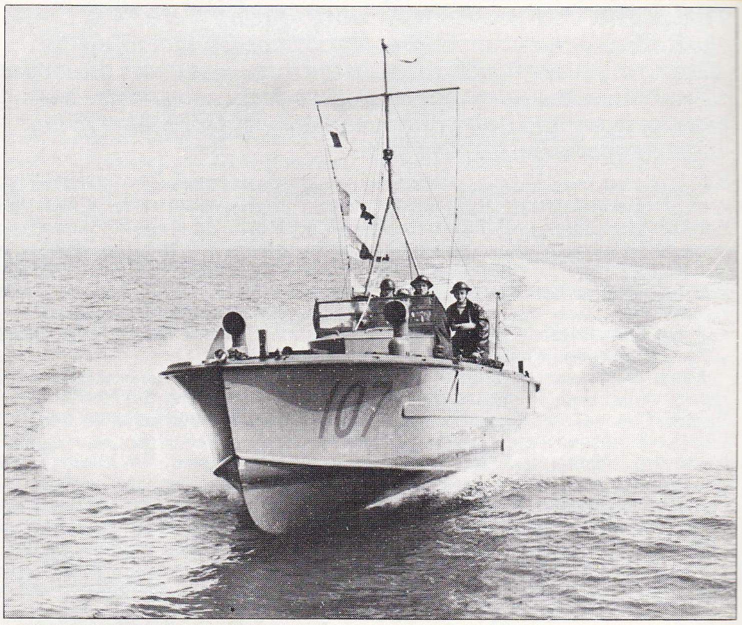
Close-in fighting was typically brief and bloody, involving large volumes of ammunition from light automatic weapons. Armour was gradually introduced as a result, the Germans going as far as an armoured wheelhouse. Initially the British were at a disadvantage with only machine-guns to match the German 20-mm cannon, whose explosive or incendiary shells were lethal to wooden hulls loaded with petrol and ammunition.

As ever, armament developed to suit the need. American PT boats, involved in the Far East against the eternal and apparently unstoppable Japanese barge traffic, shed some or all of their torpedoes in favour of weapons such as racked 127-mm (5-in) rockets and 81-mm (3.2-in) mortars. British boats faced similar problems with the German MFPs, or 'F' lighters, in such areas as the Aegean and Adriatic. Like the Japanese, these craft were of a draught too shallow to be vulnerable to torpedoes and could take aboard a variable armament which often included the much-respected 88-mm (3.46-in) gun. British MGBs responded appropriately, toting guns as large as the short-barrelled 114-mm (4.5-in) gun.

Radar, once available to small craft, was a boon in the vicious nocturnal encounters where opponents could usually be seen only fleetingly and for very short periods. Paradoxically, it was radar-controlled gunfire on the part of larger ships that offset the torpedo boat's advantages by effectively outranging its main weapon.

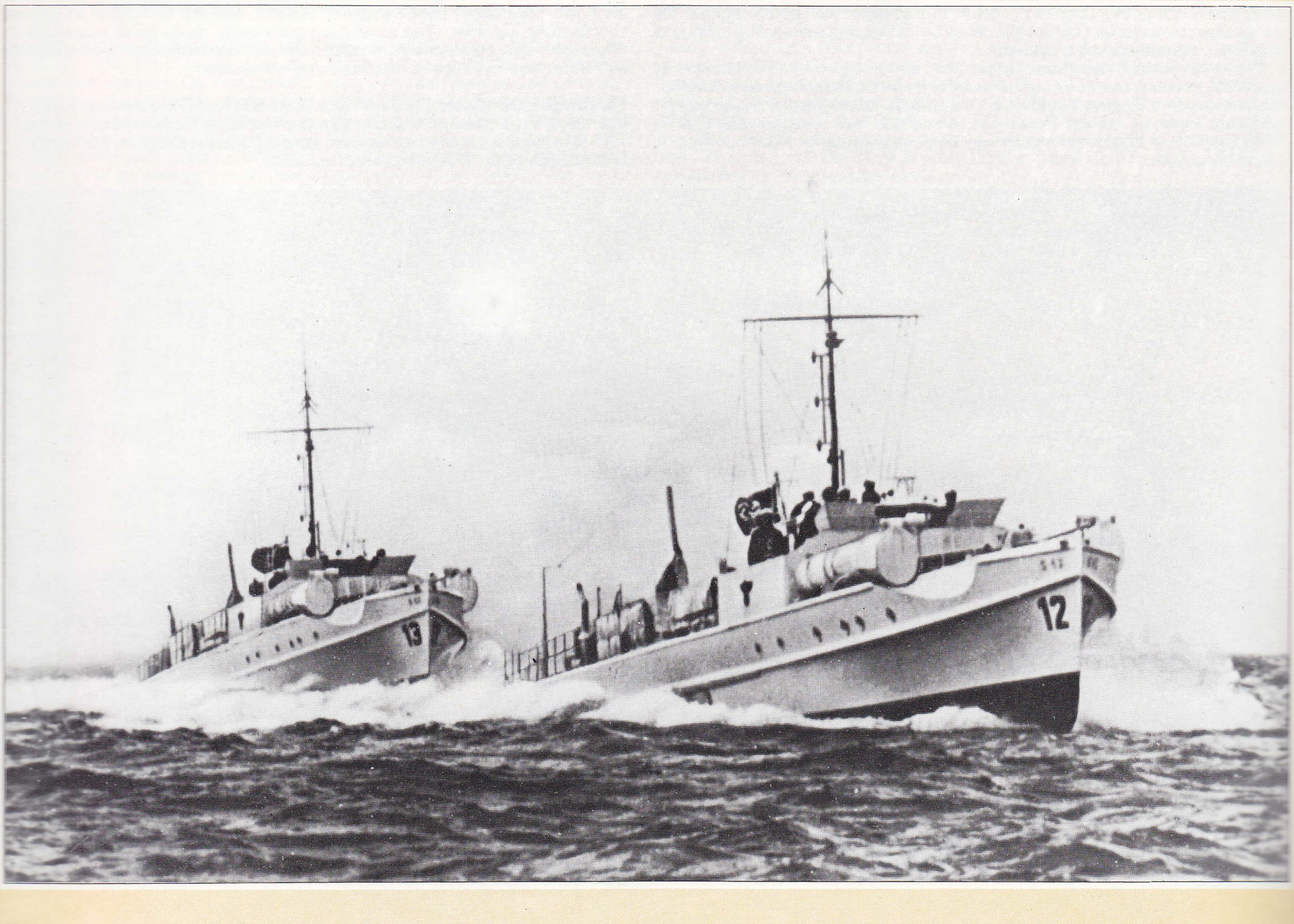
Come the peace there was no sentiment, the boats being deleted in hundreds, many destroyed by burning and many surviving a swords-to-ploughshares transfiguration to become houseboats of surprising durability.

Interest in small craft lapsed again on the part of the larger navies until that day in 1967 when the *Eilat* became the first major SSM casualty.



This British MTB *was one of a series of experimental light torpedo boats built in 1940 to test the inter-war concept of small torpedo boats carried aboard mother ships. The 44-ft no. 107 carried her torpedoes in stern troughs, an arrangement which did not prove satisfactory.*

S12 *and* S13 *were part of the first batch of German motor torpedo boats, completed in 1934. Displacing 78 tons, they were 32.3-m (106-ft) boats armed with two 533-mm (21-in) torpedoes and a single 20-mm (0.78-in) gun intended for an AA role.*

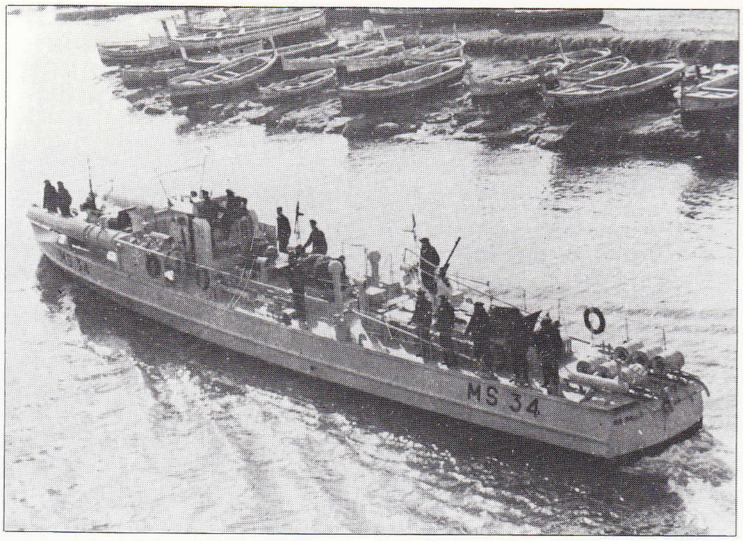


ITALY

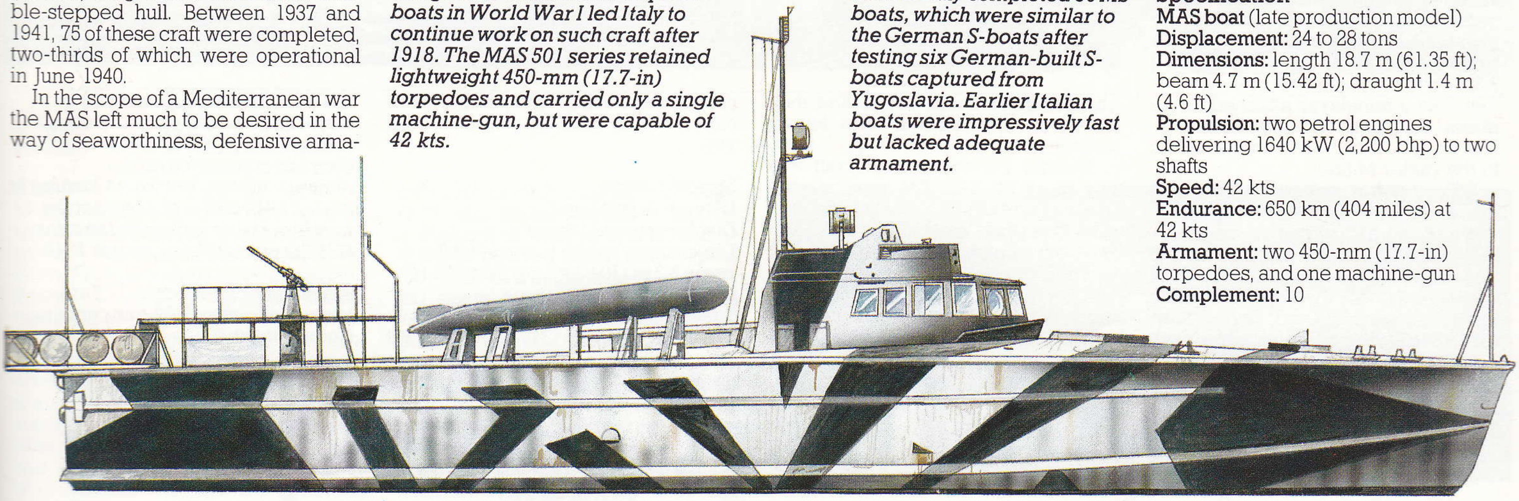
MAS boat

During World War I the Italians operated a large number of small torpedo craft, their lack of size and endurance being offset by the fact that the principal enemy was neighbouring Austria-Hungary. Their speed also appealed greatly to the Italian character. The craft were used with boldness and imagination, their major successes being the sinking of the battleships *Wien* and *Szent Istvan*. Unlike the larger fleets that lost interest in such craft after World War I, the Italian navy pursued **MAS** development, but the results were not particularly good because of the lack of suitable engines. To save both space and weight, the Italians favoured dropping gear for their 450-mm (17.7-in) torpedoes to the more usual troughs or tubes. Only with quantity production of the excellent Isotta-Fraschini petrol engine in the mid-1930s could the Italians field a reliable and fast craft. These were of the **MAS 500** series, early boats being 17 m (55.8 ft) long and later ones 18.7 m (61.35 ft) long with a hard-chine double-stepped hull. Between 1937 and 1941, 75 of these craft were completed, two-thirds of which were operational in June 1940.

In the scope of a Mediterranean war the MAS left much to be desired in the way of seaworthiness, defensive armament and capacity for punishment. In April 1941 the Italians captured six 28-m (91.9-ft) non-operational Yugoslav boats, built in Germany in 1936-7 along standard S-boat lines. These were petrol-engined and were made serviceable with no co-operation at all from Italy's axis partners. They immediately showed the advantages of size and the displacement hull form. The MAS was summarily abandoned as a type in favour of an S-boat 'Chinese copy' known as ***Motosiluranti***, or **MS** boats, of which 36 were completed. Accustomed to speed as a protection, the Italians tended to over-arm their MS craft without armouring them. Their petrol engines proved a liability and, finally, when the Germans at last agreed to provide Daimler-Benz diesels and drawings for the later S-38 type, it was too late to be of use and none had been even launched by the armistice in September 1943.



Above: Italy completed 36 MS boats, which were similar to the German S-boats after testing six German-built S-boats captured from Yugoslavia. Earlier Italian boats were impressively fast but lacked adequate armament.



The great success of her torpedo boats in World War I led Italy to continue work on such craft after 1918. The MAS 501 series retained lightweight 450-mm (17.7-in) torpedoes and carried only a single machine-gun, but were capable of 42 kts.

Specification

MAS boat (late production model)
Displacement: 24 to 28 tons
Dimensions: length 18.7 m (61.35 ft); beam 4.7 m (15.42 ft); draught 1.4 m (4.6 ft)
Propulsion: two petrol engines delivering 1640 kW (2,200 bhp) to two shafts
Speed: 42 kts
Endurance: 650 km (404 miles) at 42 kts
Armament: two 450-mm (17.7-in) torpedoes, and one machine-gun
Complement: 10

ITALY

VAS boat

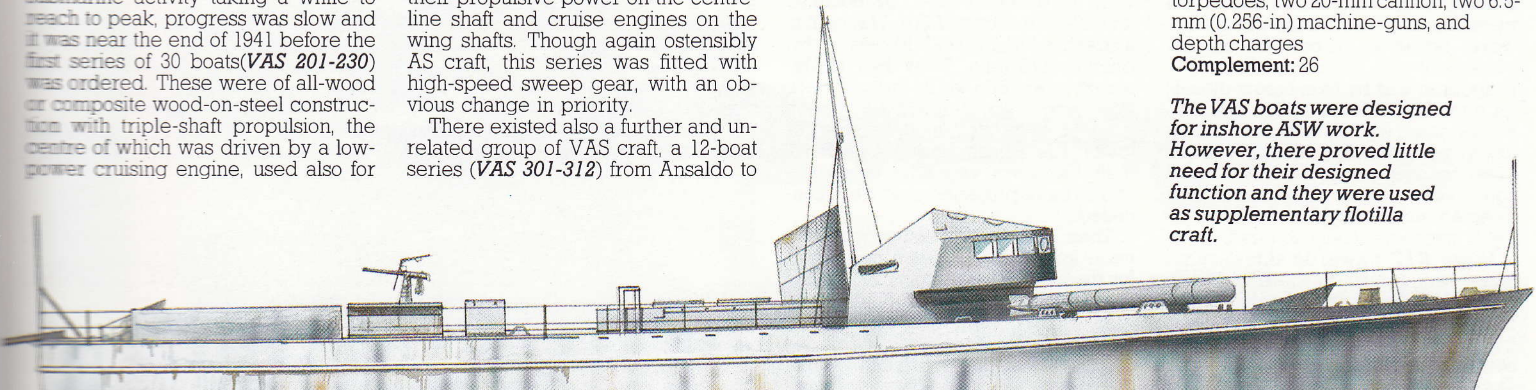
The **VAS** ***(Vedette Antisommergibili)*** bore roughly the same relationship to the MAS as did the R-boat to the S-boat in the German fleet. Little attention had been paid before World War II to the possibilities of having to counter a submarine offensive, an area that lacked glamour to naval planners bent on creating a fleet appropriate to the character and aspirations of their leader. To complement a crash programme of corvettes were the VAS boats, designed to work inshore. With British submarine activity taking a while to reach to peak, progress was slow and it was near the end of 1941 before the first series of 30 boats(***VAS 201-230***) was ordered. These were of all-wood or composite wood-on-steel construction with triple-shaft propulsion, the centre of which was driven by a low-power cruising engine, used also for quiet manoeuvring. Although capable of just under 20 kts flat out, the VAS were equipped with a pair of 450-mm (17.7-in) torpedoes in dropping gear. As the boats carried only light automatic guns, the function of the torpedoes was to destroy any submarine forced to surface by the boat's 30 depth charges.

A second group of 18 boats (***VAS 231-248***) was ordered in 1942, slightly increased in beam but differing fundamentally in having the better part of their propulsive power on the centreline shaft and cruise engines on the wing shafts. Though again ostensibly AS craft, this series was fitted with high-speed sweep gear, with an obvious change in priority.

There existed also a further and unrelated group of VAS craft, a 12-boat series (***VAS 301-312***) from Ansaldo to the yard's own design. These were much larger 34-m (111.55-ft) craft of all-steel construction. They should have been diesel-propelled, but the Italian-designed engines proved unsatisfactory, the boats taking the same machinery as the second series. Only half the class was ever to complete in time to see service under the Italian flag, the remainder being captured by the Germans at the capitulation. Most were sunk or scuttled, and few served for any time in their designed function.

Specification

VAS boat (2nd series)
Displacement: 69 tons
Dimensions: length 28.0 m (91.86 ft); beam 4.7 m (15.42 ft); draught 1.4 m (4.6 ft)
Propulsion: one petrol engine delivering 857 kW (1,150 bhp) and two petrol engines each delivering 224 kW (300 bhp) to three shafts
Speed: 20 kts
Endurance: not known
Armament: two 450-mm (17.7-in) torpedoes, two 20-mm cannon, two 6.5-mm (0.256-in) machine-guns, and depth charges
Complement: 26



The VAS boats were designed for inshore ASW work. However, there proved little need for their designed function and they were used as supplementary flotilla craft.

GERMANY

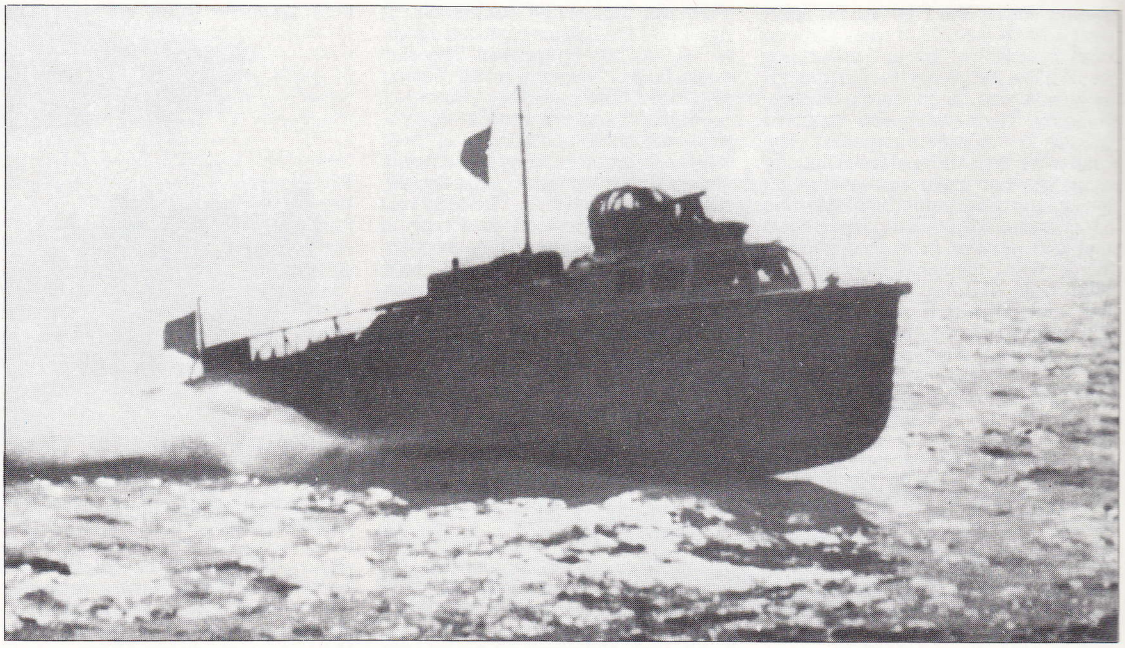
LS and KM

Paralleling the carriage of small torpedo craft by major units in the Victorian era, the pre-war German navy investigated two possibilities of stowage for a small *Schnellboot*. Two 12.5-m (41-ft) **LS** type prototypes were built in the late 1930s, light enough to be handled by heavy deck gear yet able to carry two 457-mm (18-in) torpedoes. Only one of these, built of light alloy, met the weight limit and was put into service as ***LS2*** (LS for *Leicht Schnellboot*). The torpedo gear was not standard in the German navy and was not available in time, so the boat was modified to lay three mines through apertures in the broad transom. Though this reduced the direct usefulness of the craft, she was shipped as an auxiliary aboard the raider *Komet*. The boat was a failure as the aero engines fitted in place of the planned diesels (also not available) failed with vibration and transmission problems.

LS3 and ***LS4*** both received their designed pair of Daimler-Benz diesels, an interesting feature being that a gearbox was added to increase engine speed by 50 per cent to drive the propellers at a supercavitating 3,300 rpm. Of these two craft the former was a minelayer attached to the raider *Kormoran*, and the latter (the first torpedo-fitted boat) was attached to the raider *Michel*.

Official policy regarding the use of these interesting little craft, which were armed also with a 15-mm or 20-mm gun in an aircraft turret, seemed to be lacking. Of the remaining eight that were completed, most went overland to the Aegean to be used, ineffectually, for AS duties, carrying 11 depth charges but no sonar. In practice, they acted as high-speed inter-island vedettes.

Another innovative little craft was the 16-m (52.5-ft) **KM** type coastal minelayer (KM for *Küstenminenleger*). Equipped with twin 410-kW (550-hp) aero engine drive, these 36 craft had sufficient speed to reach the British coat with four mines and return during dark hours, having placed them far more accurately than aircraft. They proved too small for the job and were expended in theatres with sheltered waters.



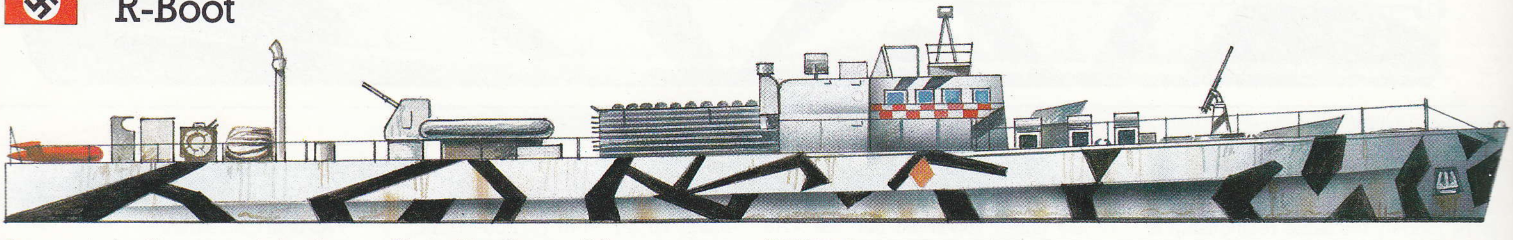
***LS4** was fitted with an aircraft gun turret and two 533-mm torpedoes. Named 'Esau', it was carried by the German commerce raider* Michel, *which sailed from Flushing in March 1942 and met its end at the hands of the American submarine USS* Tarpon *off Yokohama in 1943.*

Specification

LS type (as designed)
Displacement: 11.5 tons
Dimensions: length 12.5 m (41.0 ft); beam 3.3 m (10.83 ft); draught 0.76 m (2.5 ft)
Speed: 42.5 kts
Endurance: 555 km (345 miles) at 30 kts
Armament: two 450-mm (17.7-in) torpedoes, and one 20-mm cannon
Complement: 9

GERMANY

R-Boot



***Above:** The German R-boats were pressed into service as minelayers and convoy escorts. Although they received increasingly powerful diesels they could rarely manage much more than half the maximum speed of an S-boat.*

Raumen is the German verb 'to clear or 'to remove', hence the **Raumboot** or **R-boat** type of coastal minesweeper. These craft were of such a useful size, however, that they also did duty as minelayers and, suitably rearmed, as escorts to convoys, in which guise they were involved in frequent brushes with British craft.

The original group, ***R1-16***, was constructed in the early 1930s. Like the S-boats, they were built of wood on metal framing with round bilges. They were, however, of only 60-ton displacement and 26-m (85.3-ft) length. Propulsion was by twin-screw diesels for a modest 17 kts although one unit, *R8*, was fitted with Voith-Schnider cycloidal propellers, which made for great manoeuvrability at the cost of some speed. This experiment was deemed successful, and over 100 R-boats were eventually so fitted.

From ***R17*** onwards dimensions were very similar to those of the S-boats, though with extra beam, and increased draught by virtue of their greater displacement. Even with progressively improved diesels, the average R-boat never much exceeded 20 kts and, when not actually involved in the minesweeping for which the type had been designed, was employed defensively. The exceptions were the dozen so-called **GR-Boote** (G for *Geleit*, or escort), ***R301-312***, built to a stretched 41-m (134.5-ft) design displacing 175 tons. They had triple-screw propulsion for 24 kts and were fitted with a pair of torpedoes. Though used in something like the role for which the British employed MGBs, their firepower was little enhanced, and 88 more projected craft were cancelled.

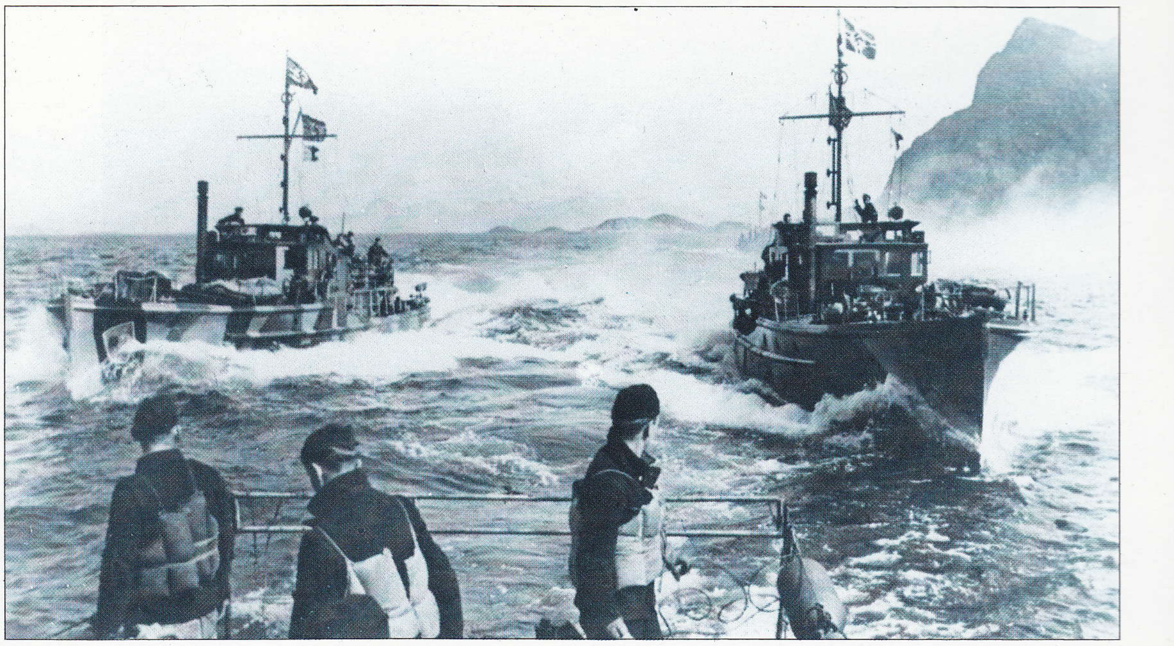
Their construction did suggest the need for a true multi-purpose escort for the many coastal convoys that the Germans ran around North European waters. The result was the hybrid, steel-built **MZ-Boot** design (Mz for *Mehrzweck*, or multi-purpose) which, while having a heavy surface armament including two 88-mm (3.46-in)

An R-boat is shown off the Norwegian coast, where the Germans ran so many convoys that they constructed a purpose-built convoy escort based on the R-boat design. By 1944 R-boats bristled with guns, carrying a 37-mm (1.45-in) cannon and up to six 20-mm mounts. Many were fitted with Voith Schneider propellers, which increased manoeuvrability at the expense of some speed.

guns and two torpedo tubes, were of only single-shaft propulsion. Only ***Mz1*** was ever completed, not proving sufficiently satisfactory to warrant further priority being given for completion of the remaining 11.

Specification

R-boat 140-ton type
Displacement: 140 tons standard
Dimensions: length 40.0 m (131.23 ft); beam 5.6 m (18.37 ft); draught 1.45 m (4.75 ft)
Propulsion: two diesels delivering 1901 kW (2,550 bhp) to two shafts
Speed: 20.5 kts
Endurance: 2040 km (1,268 miles) at 15 kts
Armament: one 37-mm cannon and up to six 20-mm cannon
Complement: 38



The R-boats were originally 60-ton craft armed with a couple of 20-mm cannon plus depth charges or mines, as appropriate. From R17 on they grew to S-boat size, and mounted an increased armament – necessary on the vital Norwegian iron ore route.

GERMANY

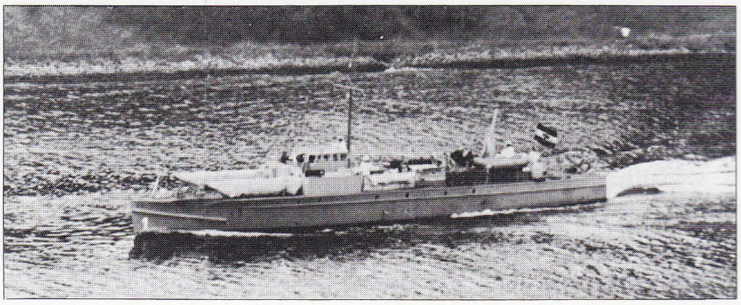
S-Boot

Known to the British for some ill-defined reason as an **E-boat**, the German *Schnellboot*, or **S-Boot**, differed greatly from its Royal Navy counterparts. From its origins in a Lürssen civil design of the early 1930s, the S-boat was built of wood on alloy frames and had a round-bilged hull form which, while possessing a lower maximum speed than the hard-chined British equivalents, was very much more sea-kindly. In the event, the S-boat was able to sustain its maximum speed in sea states that forced the British to throttle back to avoid excessive pounding.

Diesel drive was specified from the outset, though the prototype ***S1*** of 1930 and the follow-on ***S2-S5*** of 1931-2 had to take petrol engines while Daimler-Benz and MAN developed a suitable unit. Only with the ***S6-13*** of 1934-5 did the three-shaft diesel layout become established. These craft were 32.4 m (106.3 ft) in length and powered for 35 kts. This speed was considered insufficient, so in the next group the seven-cylinder diesels were exchanged for 11-cylinder units, improving speed but necessitating an increase in length to 34.7 m (113.8 ft), which remained remarkably constant until 1945, in stark contrast to the variety of boats under the British flag.

Because of their greater length the S-boats carried their two torpedo tubes forward of the wheelhouse, giving space for two skid-mounted reloads abaft them. It was then a small design step from ***S26*** onwards to raise the forecastle by 1 m (3.28 ft), so enclosing the tubes and leaving a forward gun-pit between them and, importantly, raising the freeboard to give the craft an enviable dryness.

Always quieter than British equivalents, the S-boats also had a profile that was hard to spot without radar. Gun armament had continually to be increased to match that of their opponents, the extra weight being offset to a great extent by improved weight-saving techniques in hull construction and engines of higher power. Protection was improved by the adoption of the armoured 'Kalotte' type bridge. By 1945 speeds had been pushed (by extremely unreliable engines) to a maximum 42 kts and, while no longer, the ***S700*** type introduced two extra, aft-facing torpedo tubes. Over 200 S-boats were built, of which about half survived the war.

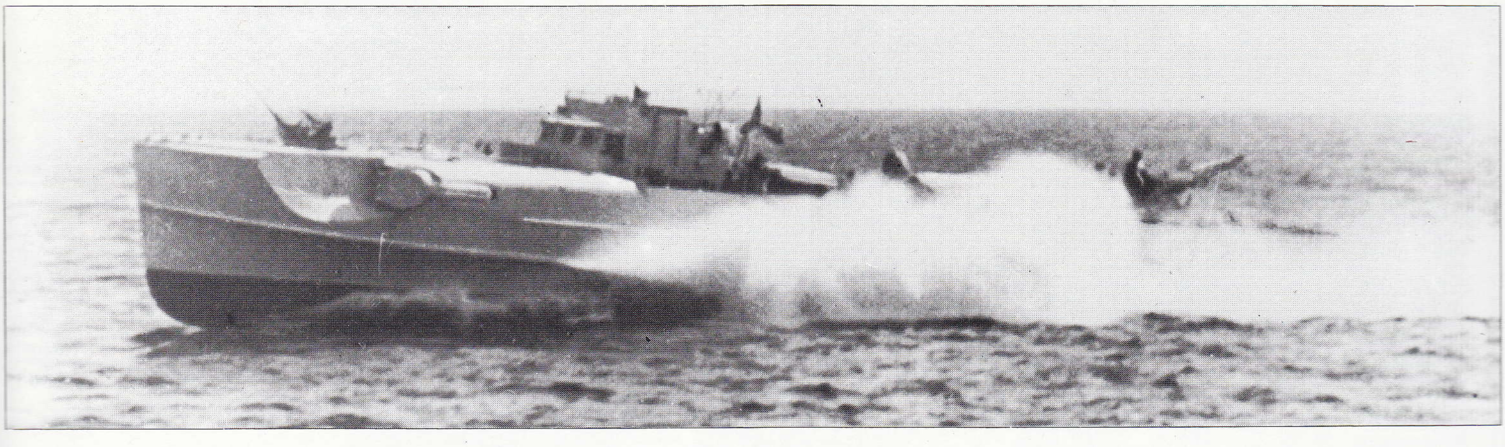


S1, the prototype S-boat, here seen in the Kiel canal, had to make do with a petrol engine while a diesel unit was perfected. The round-bilged hull enabled the S-boats to maintain high speeds even in a rough sea.

Specification

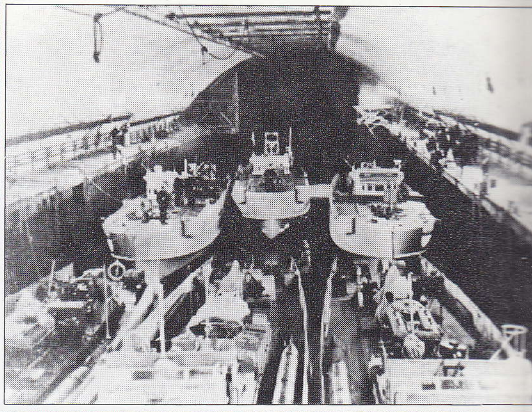
'S 26' class
Displacement: 93 tons standard and 115 tons full load
Dimensions: length 34.95 m (114.67 ft); beam 5.1 m (16.73 ft); draught 1.4 m (4.6 ft)
Propulsion: three diesels delivering 4474 kW (6,000 bhp) to three shafts
Speed: 39.5 kts
Endurance: 1390 km (864 miles) at 35 kts
Armament: two 533-m (21-in) torpedo tubes with four torpedoes, and two 20-mm cannon
Complement: up to 21

The 100-ton S81 works up to her full speed of 39 kts. Note the difference made by raising the forecastle 1 m (3.28 ft), enclosing the torpedo tubes and leaving space for a forward 20-mm (0.78-in) gun-pit. The low profile of the S-boats was a considerable advantage in the nocturnal melées along the Channel coast.



'E-Boat' Alley

From their bases in the Low Countries, German torpedo craft attacked the Thames estuary so frequently that it was dubbed 'E-boat Alley'. Publicly, the government played down the problem, but soon embarked on a programme of motor gun-boats to beat the enemy at his own game.



'E-boats' in their lair. They were in fact German S-boats, and issued forth from their concrete pens to attack the regular coastal convoys off the English coast. Bombing the pens was often tried but this seldom destroyed them; only air superiority and improved gun-boats with radar ended the S-boats' career.

The UK's war effort depended on electrical power from the national grid, and the power stations that fed it were coal-fired. Those removed from the coal fields were, for the most part, situated on the coast, where their unending appetite could be satisfied directly by colliers. Most of these were small, between 1,000 and 2,000 deadweight tons, sized to penetrate to a hundred obscure quays. Similar-sized coasters moved a host of other cargoes, many to and from the major ports that serviced the ocean-going ships.

At any time literally hundreds of ships were in transit coastwise, many of them large deep-sea vessels on passage between ports. Their convoying had been planned before the war and began immediately on the outbreak of hostilities. Most threatened were the east and south coasts that directly faced the continent. So, between the Thames Estuary and the Tyne/Forth ran, every couple of days, the FN (northbound) and FS (southbound) convoys while, between the Thames and the Solent/Falmouth, ran the CE and CW convoys (eastbound and westbound). Complicating the latters' cycle were the ocean-bound OA convoys, also formed in the Thames.

Navigation hazards

Traffic heading north from the Thames has, for centuries, respected the hazards of navigating around the bulge of East Anglia. Channels are restricted, shallow and unstable, hemmed in between endless banks of hard, unyielding sand and a flat and largely featureless coast. With war the navigating marks were dimmed or extinguished, moved or removed, and a race of sturdily independent skippers was obliged to accept the group discipline of the convoy. For the first eight months of the war, the 'phoney war' beloved of journalists, the traffic suffered only sporadically from air attack, but more seriously from mines. Aircraft and submarine 'lays' were unsatisfactory to the Germans on the grounds of both quantity and accuracy, so destroyers (carrying 60 mines apiece) undertook a series of nocturnal forays, placing 11 fields off the Tyne, the Humber, the East Anglian coast and the Thames. These alone were to claim 76 known victims and the sight of masts and funnels protruding from the silt-laden waters began to be depressingly familiar.

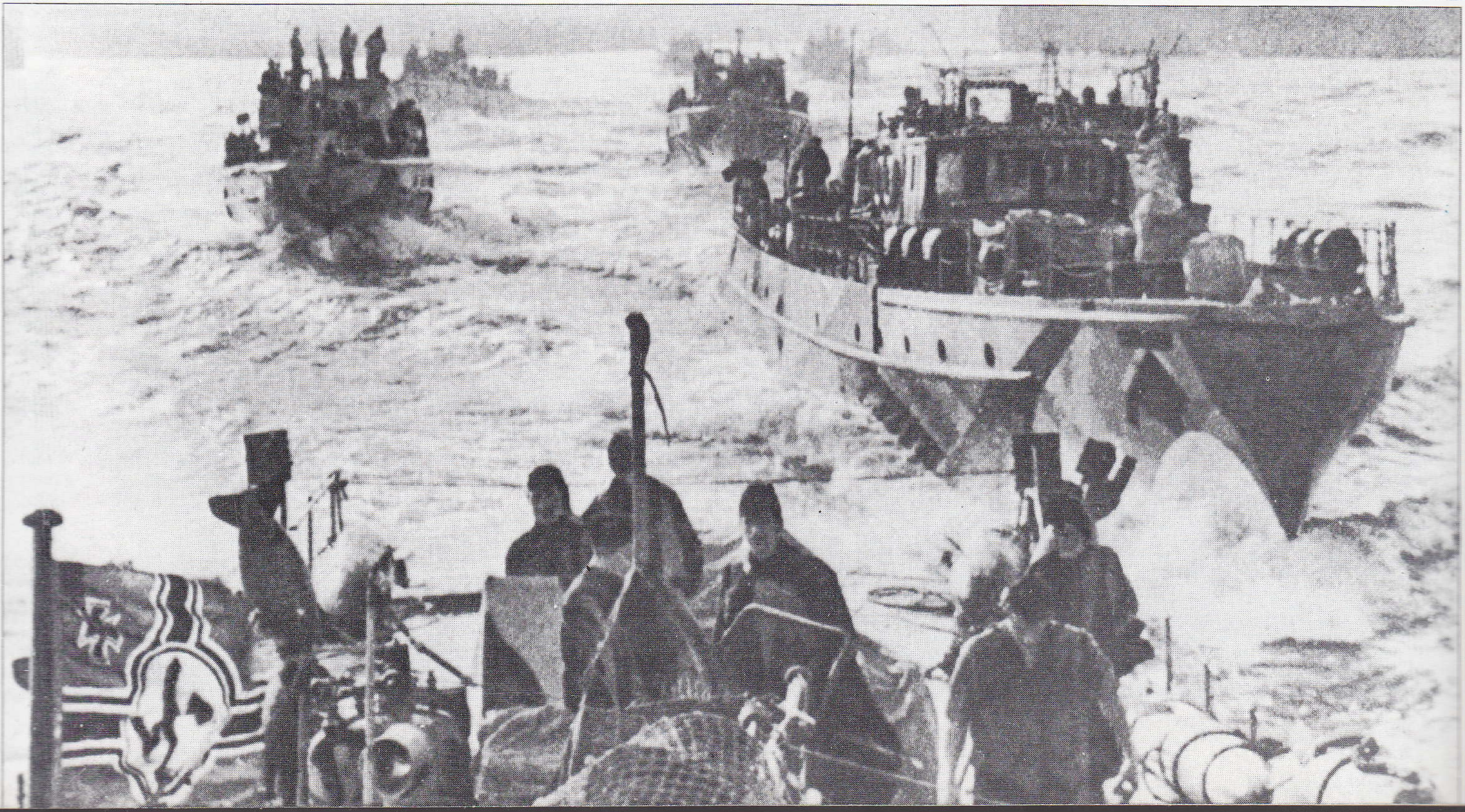
Straggling convoys

Sheer numbers of ships saw convoys up to 60 strong in the early days. Narrow offshore channels often resulted in these convoys being strung out over 32 km (20 miles), impossible for their few escorts to cover adequately and a soft target for the Luftwaffe.

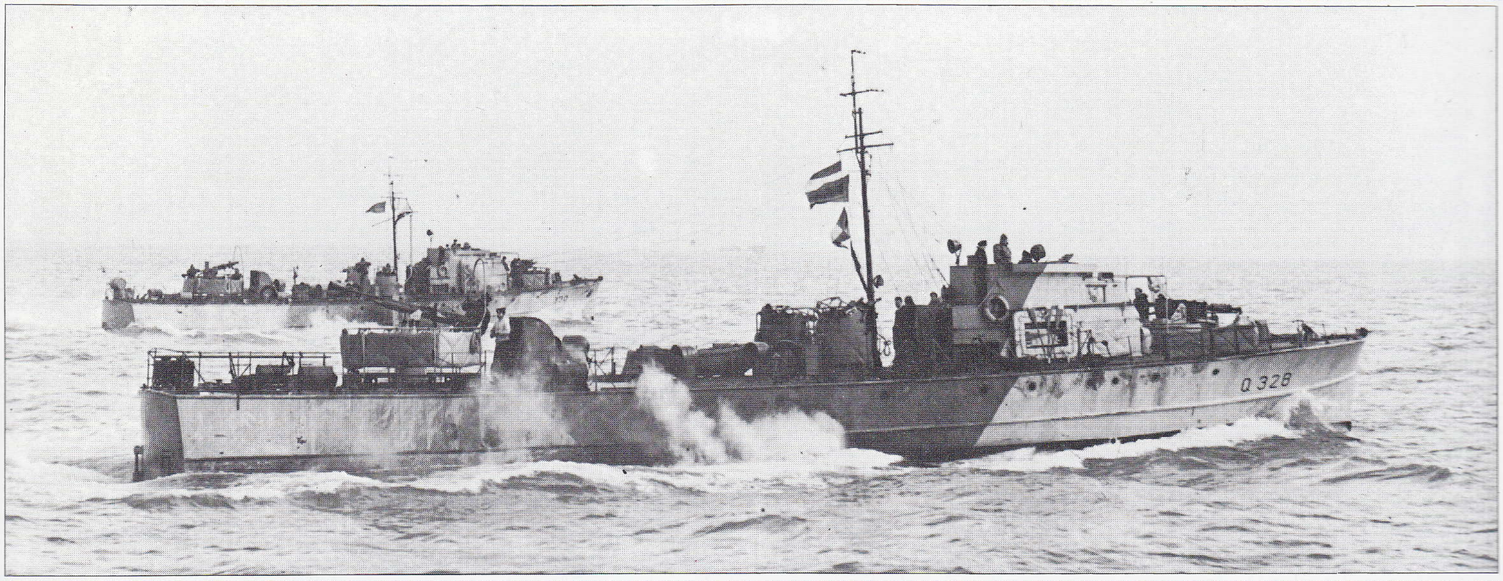
Some ships received a measure of defensive armament, and some carried naval parties with Lewis guns who took passage, returning with another convoy; most had nothing. Hit and run aerial attacks were often effective and very hard to counter as the RAF had too few fighters to mount continuous cover, and to respond to a call for assistance was usually to be too late.

April 1940 saw the great German offensive in the West, starting with the Scandinavian campaign. In May, even before Dunkirk, the Dutch ports were taken and, with their availability, came the S-boats, known universally to the British as 'E-boats'. Barely 160 km (100 miles) – a three-hour passage – from the English East Coast, they rapidly made themselves known. On the night of 9/10 May, the British destroyer HMS *Kelly* was all but destroyed by a group of four boats whose presence had not even been suspected. During the Dunkirk operation a few weeks later, three British and French destroyers were sunk and two heavily damaged. Working singly or in small groups, the S-boats combined boldness with a low and rather nondescript appearance in attacks that proved highly effective and which earned them something of a 'bogey' image. Their first move against a coastal convoy, off Dungeness on the night of 19/20 June 1940, claimed one ship.

With the fall of Europe, the battle for aerial superiority over the UK began in earnest. Coastal convoys were bombed remorselessly by day to lure the understrength RAF fighter



R-boats in the Channel in 1940, a period when the German flotilla had little worry about air attack and could concentrate on British shipping. Minelaying R-boats were arguably more effective than the more glamorous S-boats with their high-speed torpedo attacks.



squadrons out to their defence. The ploy did not work, the service saving itself for the greater battle yet to come, but the convoys suffered. Fully aware of their importance, the Germans allowed them no respite, using also the S-boats by night.

Destroyer escorts

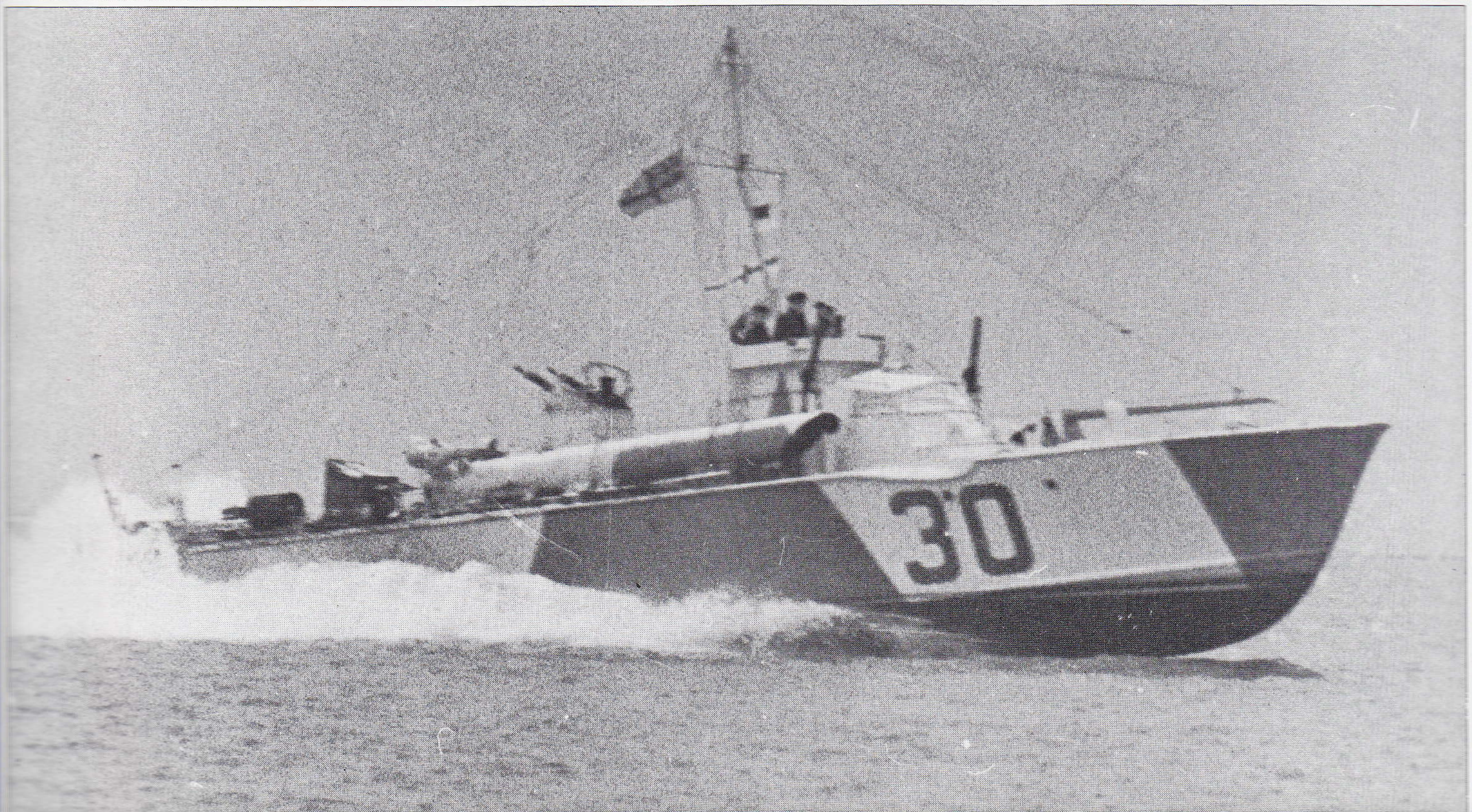
Mounting losses forced the British to run smaller, more manageable and more easily defended convoys and to re-route the OAs northabout. Trawlers and MLs acted as 'tripwires', balloon and kite ships kept the would-be strafers higher and, best of all, the 'Hunt' class escort destroyers were becoming available. In a lop these could almost pace an S-boat and their 101.6-mm (4-in) guns had an uncomfortably high rate of fire. They also had radar and even a 2-pdr right forward for use in hot chase.

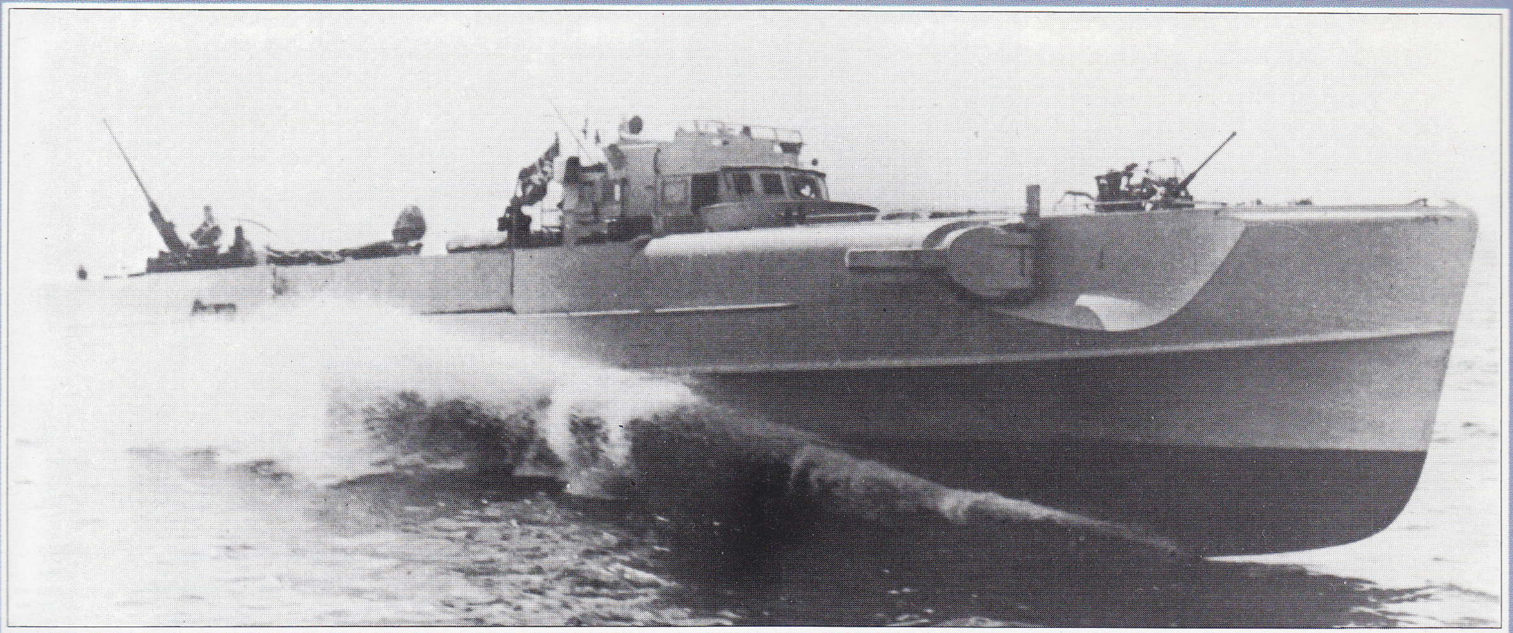
In terms of shipping sunk rather than offensive effect, the S-boat campaign would probably have had even more results if the Germans had concentrated on minelaying. This form of warfare lacked the glamour of direct combat, but was extremely disruptive and cost-effective. With their shallow draught, the S-boats were able to thread the gats and swatchways offshore to lay their mines where it hurt most. In doing so, however, they began to run foul of a new British antidote, the Motor Gun Boat (MGB). These, in the form of re-armed 'Masby' boats, were introduced in March 1941 and, under the leadership of such as Robert Hichen, began to challenge the S-boats directly. The big Fairmile 110-footers, which followed, were capable of making the Germans' lives really uncomfortable. Most of the British boats were RNVR-manned, 'Hostilities Only' sailors drawn from the ranks of pre-war yachtsmen whose enthusiasm for the task was matched by their experience of shoal waters. As it happened their arrival coincided with a temporary slackening of the enemy onslaught, as three of his four Dutch-based flotillas were withdrawn to the Baltic pending the opening of the war against the USSR. The respite was brief as more enemy boats soon came into service.

British countermeasures to the S-boats involved a plethora of coastal craft, these being Fairmile 'C's (converted from Fairmile 'A' minelayers) of the Dover Patrol. Largely manned by RNVR personnel with great experience of shoal waters, the MGBs could gain the edge in a gun duel as they were unencumbered by mines or torpedoes.

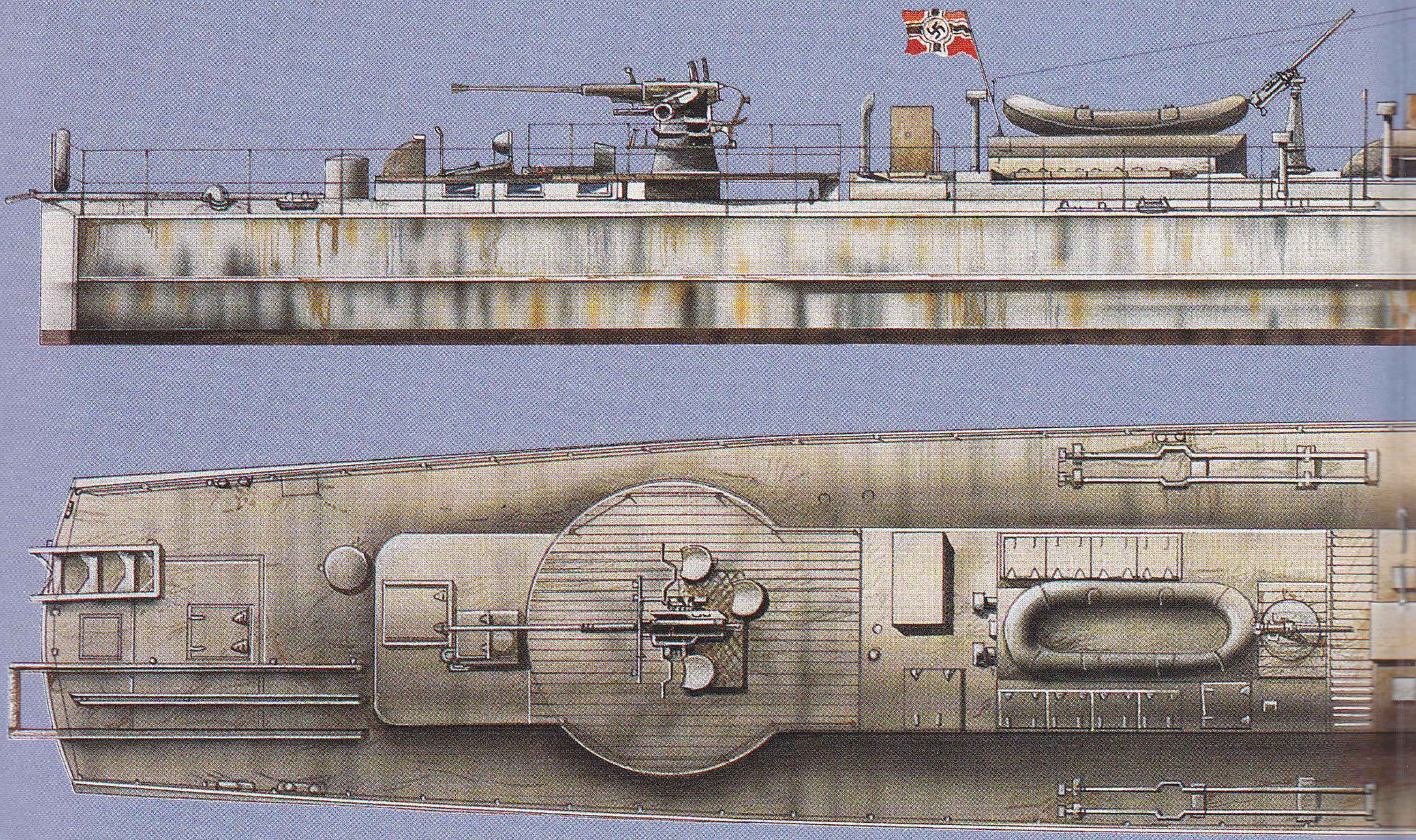
Most boats, of either persuasion, supplemented their official armament. But where the Germans were laden with mines or torpe-

MTB 30 *was a Vosper 70-ft craft lost during 1942. These boats were powered by three petrol engines that enabled them to reach 40 kts, but they were much noisier than the S-boats – a distinct disadvantage before radar became widely available. Early models were lightly armed, the forward armament of this boat being two pintle-mounted Lewis guns.*



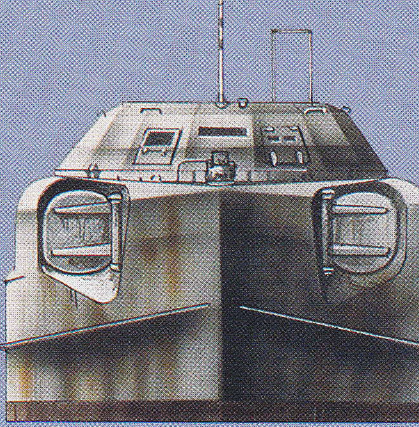


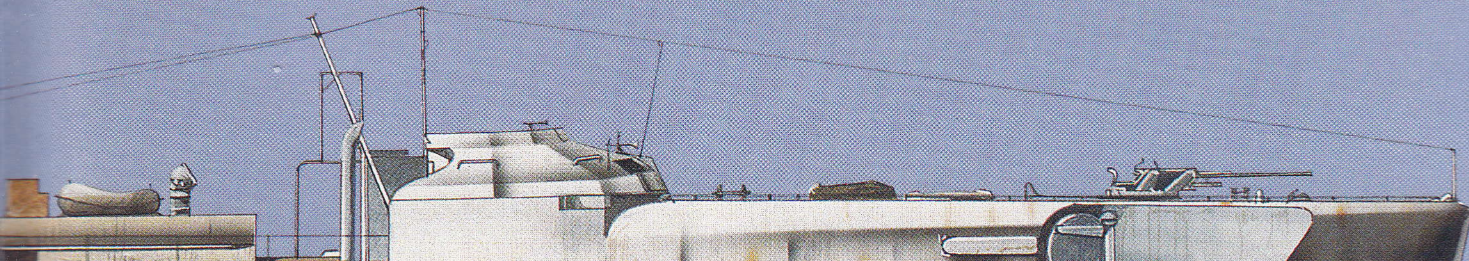
S142, *built in 1943, mounted a 40-mm (1.57-in) AA gun aft and a 20-mm (0.79-in) gun in the forward position. Displacing over 100 tons,* S142 *was among the largest S-boats built and could carry six to eight mines instead of spare torpedoes.*

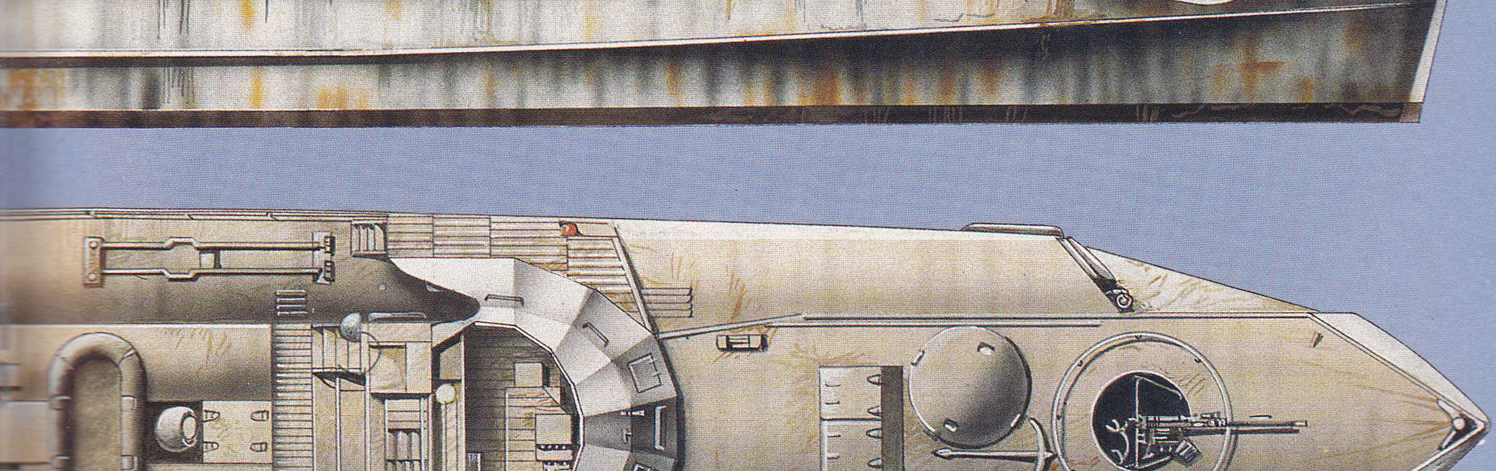


Lürssen *Schnellboot*

S-boats constructed after S66 featured an armoured conning tower as a defence against the increasingly powerful gun armament carried by British boats. Diesel propulsion was specified for the S-boats from the beginning; S6 to S13 established a three-shaft layout but the seven-cylinder diesels could only achieve 35 kts. Refitted with 11 cylinder models, S-boats grew in length to nearly 35 m but could top 40 kts. Until Royal Navy boats began to carry radar, the S-boats enjoyed the twin advantages of quieter engines and lower silhouettes.







does to carry out their primary mission, the British were not and had the edge, particularly in calm conditions. Their original machine-gun outfits were, however, at a disadvantage compared with the Germans' 20-mm cannon, which fired explosive shells that posed a grave threat to frail petrol-engined hulls. Boats lay stationary for hours, awaiting the deep throb that announced their enemy's arrival. A careful plot by ear then preceded a crash start and interception, followed by a confused melee, brief and bloody, that often found as many boats victim of collision as of gunfire.

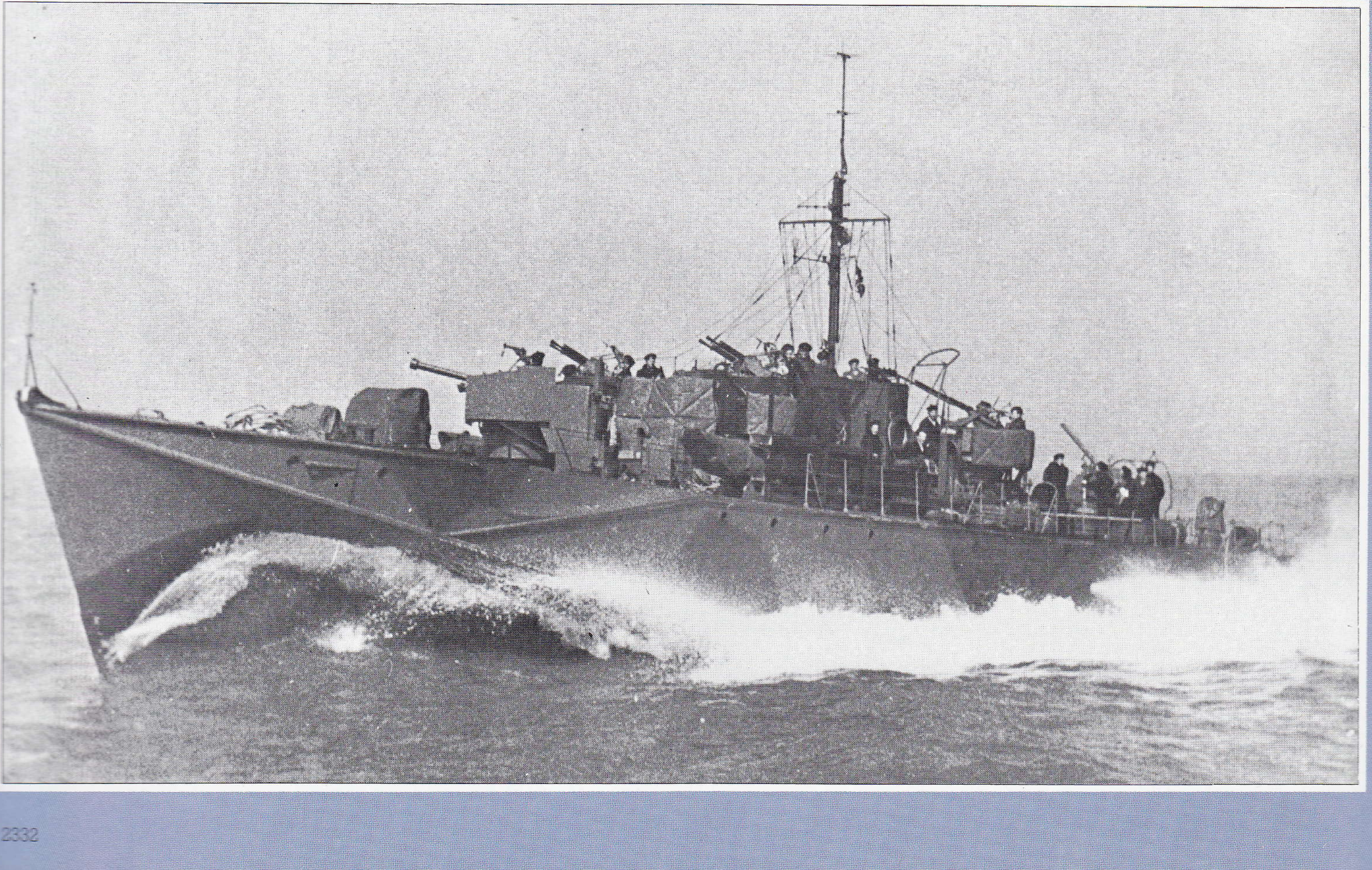
Not until 1943 was the S-boat threat contained. Aircraft increasingly attacked them as they left or returned to their bases in daylight, confining their activities more to the longer nights. Radar began to appear on British coastal craft as well as the larger escorts. With gunfire proving ever more damaging, the Germans adopted armoured bridges for their craft, slowing them further.

In contrast with earlier rapier-thrusts by a handful of boats, the Germans began to resort to the bludgeon of mass strikes. For instance, 32 S-boats hit the northbound FN 1160 convoy off Cromer on the night of 24/25 October 1943. Inevitably, so large an attack lost cohesion. Five destroyers in the close escort fought them off for the loss of one small straggler while six MGBs fell on them as they withdrew piecemeal. Two S-boats were sunk.

Throughout 1944 the Germans were increasingly fortunate to survive at all. No prior reconnaissance was available to them, and disengagement needed to be ultra-rapid to avoid the wrath of the escorts. By the end of the year as many S-boats were being lost as colliers, but even as late as 18/19 March 1945 they succeeded in sinking two of FS 1759 by torpedo off Lowestoft. Fighting long and hard they maintained the evil reputation of 'E-Boat Alley' to the end, but they eventually lost their cause by having to battle alone against an increasingly effective and co-ordinated opposition.

Above: Konteradmiral Karl Brüning salutes Commander D.H.E. McCowan after surrendering his command at Felixstowe. His S-boats were the first German surface craft to capitulate in May 1945.

Below: A major reason for the containment of the S-boat threat was the advent of such Allied craft as the Fairmile 'D' series of MGB/MTB. Big, fast and heavily armed, these powerful boats were also fitted with radar, negating the night-fighting advantage given to the Germans by their boats' low profiles.



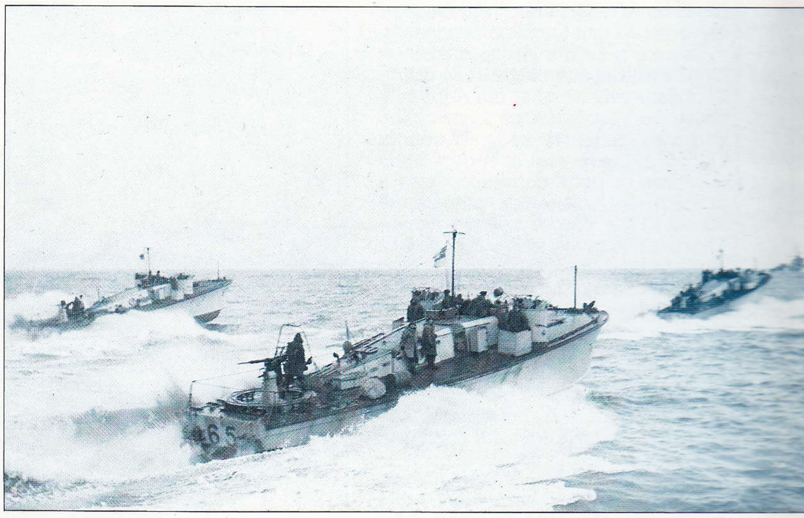
UK

British Power Boats 60-ft types

As a result mainly of lack of funds, the British did not develop the CMB concept further until 1935, when British Power Boats interested the Admiralty in an 18.3-m (60-ft) boat developed as a private venture. It was wooden-hulled with, initially, aluminium decking and, in contrast to the CMB, was hard-chined without a step. Two 457-mm (18-in) torpedoes were carried; though launched over the stern as in earlier boats, the arrangement was different. The torpedoes protruded through ports in the transom and had their outboard halves supported on lattice outriggers that could be hinged back on deck when not required. The engine room crew had to work with the business ends of the torpedoes supported on overhead runways over the wing shafts. Launching involved running the torpedoes up, removing their restraints and suddenly accelerating the boat. With the torpedoes having to adjust in the disturbed water of the boat's wake, aiming was somewhat haphazard.

A strong paper defence was afforded by no less than eight Lewis guns but these, being arranged in two quadruple mountings set in pits at the extreme ends of the boat, proved unsatisfactory. The hull design, though slower than that of the CMB, proved more seakindly if, like all of its kind, prone to pounding in a head sea. The **BPB 60-footer** proved seaworthy and capable of staging as far as Malta; the first type to be termed a motor torpedo boat, it rekindled interest on the part of the Admiralty.

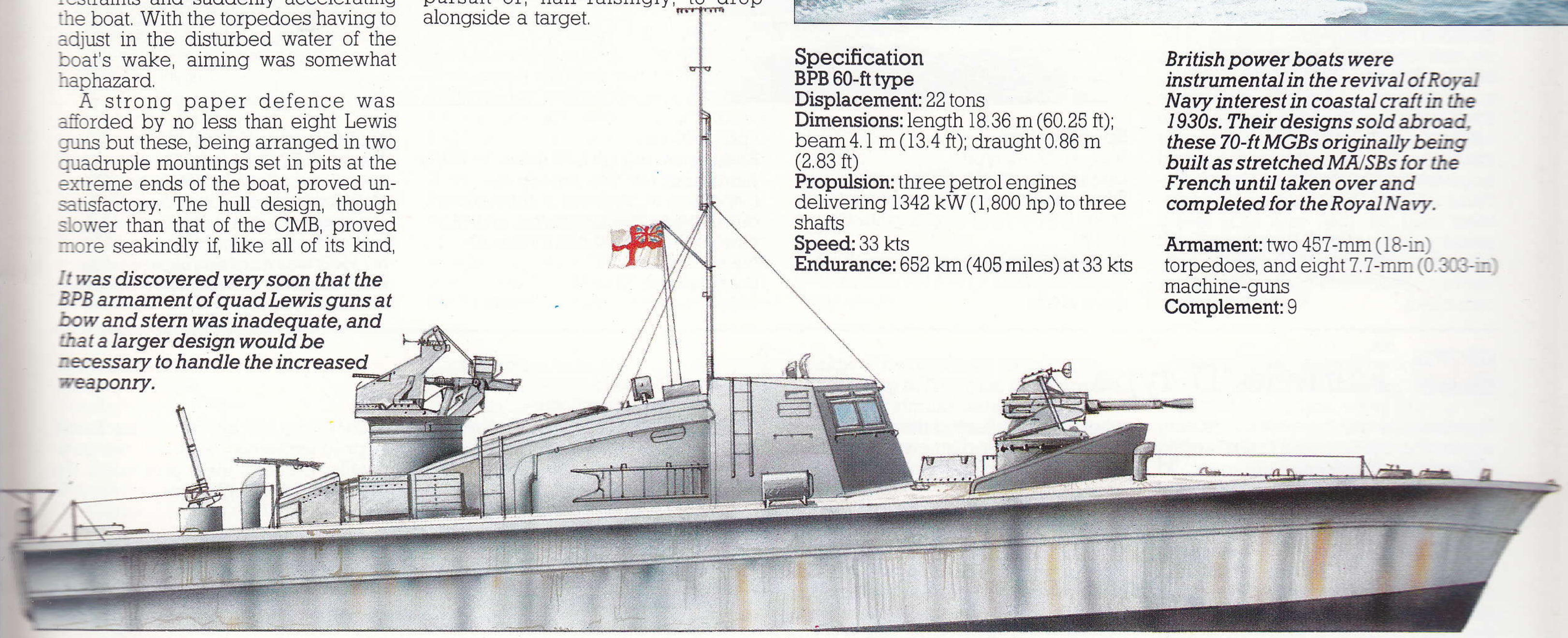
Eighteen were built in the initial batches between 1936 and 1939 (**MTB1-12** and **MTB14-19**), BPB then producing a two-engined version whose torpedoes were exchanged for depth charges. Known as **MA/SB** ('Masby') craft, they found little employment in their initial form and most were later refitted as early **MGB** types to support MTBs in their operations. For this they carried, usually, a single 2-pdr and four 12.7-mm (0.5-in) machine-guns, but many armament variations existed. Interestingly, depth charges were still often carried: set shallow, these could be used to deter pursuit or, hair-raisingly, to drop alongside a target.



British power boats were instrumental in the revival of Royal Navy interest in coastal craft in the 1930s. Their designs sold abroad, these 70-ft MGBs originally being built as stretched MA/SBs for the French until taken over and completed for the Royal Navy.

Specification

BPB 60-ft type
Displacement: 22 tons
Dimensions: length 18.36 m (60.25 ft); beam 4.1 m (13.4 ft); draught 0.86 m (2.83 ft)
Propulsion: three petrol engines delivering 1342 kW (1,800 hp) to three shafts
Speed: 33 kts
Endurance: 652 km (405 miles) at 33 kts
Armament: two 457-mm (18-in) torpedoes, and eight 7.7-mm (0.303-in) machine-guns
Complement: 9

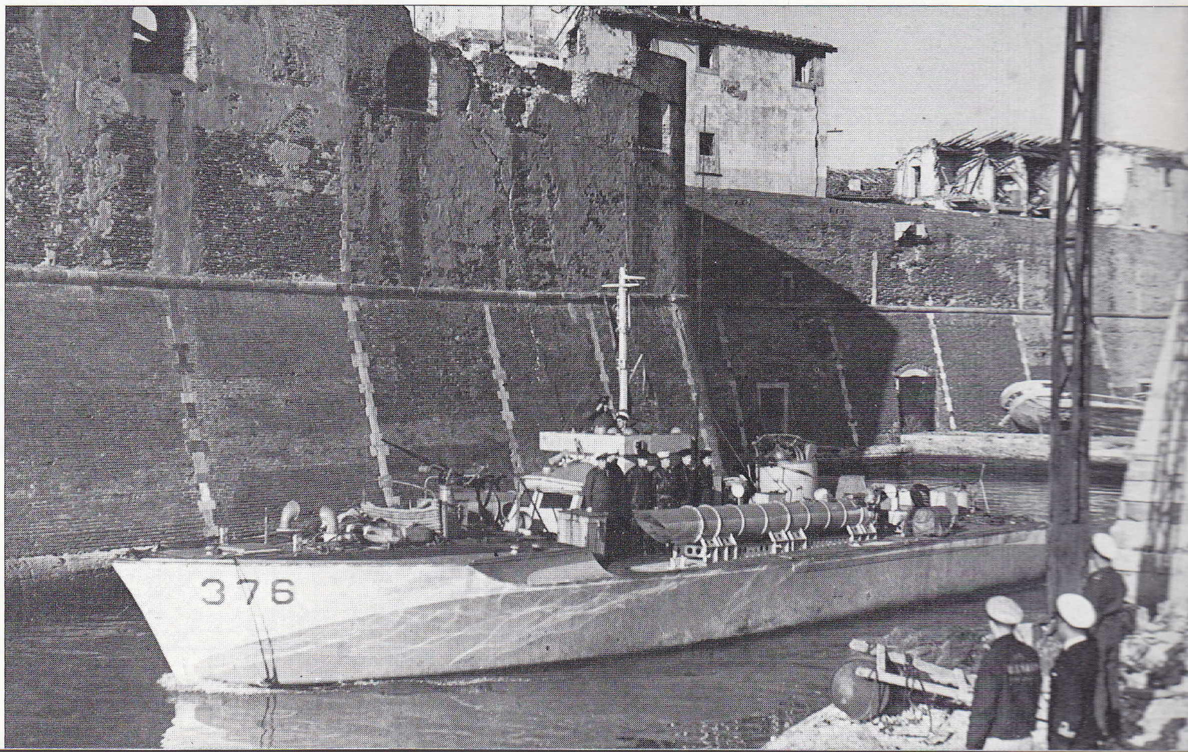


It was discovered very soon that the BPB armament of quad Lewis guns at bow and stern was inadequate, and that a larger design would be necessary to handle the increased weaponry.

UK

Vosper 70-ft type

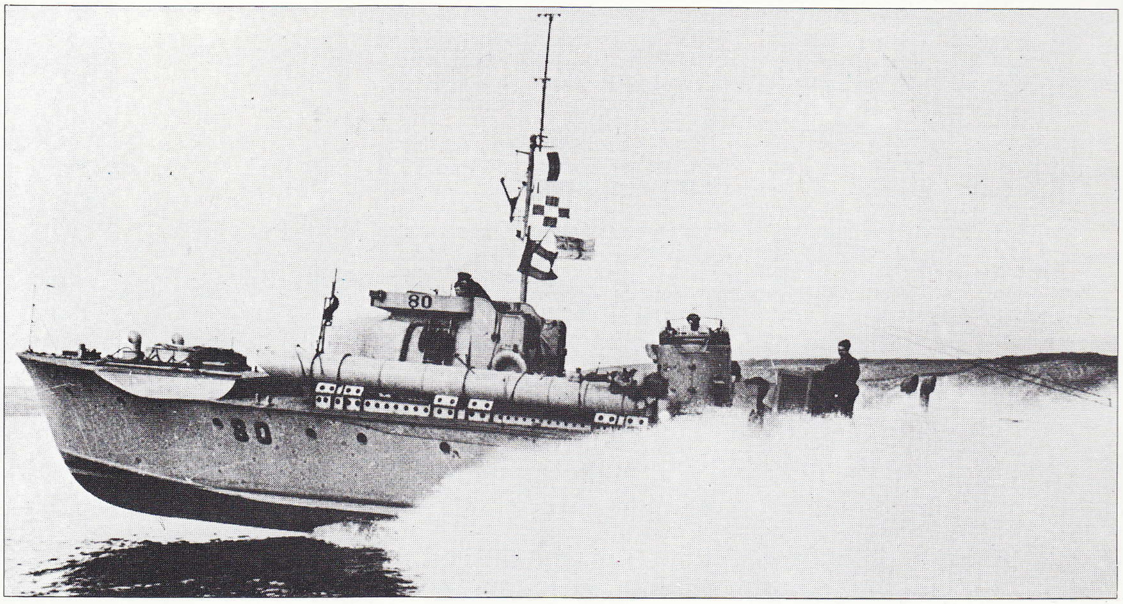
The successful **Vosper 70-ft** type originated in the single 20.7-m (68-ft) boat built by Vosper as a private venture in 1935-6 and eventually commissioned by the navy as *MTB 102*. Built completely in wood, she was driven by three Isotta-Fraschini petrol engines with a maximum output of 2573 kW (3,450 bhp). These drove the boat at a maximum speed of nearly 44 kts in calm water, and were chosen as no British-built equivalent existed. Like all such engines they were extremely noisy, so a low-power Ford engine was also available to clutch into the wing shafts for a low-speed, but silent, approach. Centreline torpedo tubes were originally included, one forward and one aft. But the navy did not like them and developed the sided arrangement adopted thereafter. *MTB 102* was notable also for being the first



MTB 376, a US-built Vosper design, supplied under Lend-Lease, leaves harbour at Livorno. Both Royal and US Navies were involved in operations between Genoa and La Spezia from May 1944, and achieved considerable success harrying German supply convoys.

Royal Navy vessel fitted with the later universal 20-mm Oerlikon cannon.

Despite a further strong challenge by BPB with an alternative 21.34-m (70-ft) private-venture boat, the Admiralty chose the Vosper design as being the stronger in heavy seas. (Actually keeping these fast wooden hulls together in poor conditions was a problem that was never satisfactorily solved.) Four Vosper and two similar Thornycroft boats were ordered in 1938 and provided the basis for the war programme, with little design change except a nominal increase in length to improve seakeeping and cater for the growing load of topweight. Alternative engines were a problem; a few converted Merlins were coaxed from the Air Ministry but many boats had to take low-powered Hall-Scotts until the powerful American Packard became available. Oerlikons were virtually unobtainable, and the alternative 7.7-mm (0.303-in) machine-guns proved of little use against E-boats running as MGBs. Eventually 12.7-mm (0.5-in) machine-guns and 6-pdr guns were fitted which, with radar, made for an efficient night-fighting boat. Stronger but lighter hulls, together with uprated engines, meant that boats were carrying a 70-per cent increased equipment load by 1944 with little speed penalty. Orders for 193 boats were met between 1939 and 1945 with the exception of a few late boats which were cancelled.



Specification
Vosper 72.5-ft type
Displacement: 36 to 49 tons
Dimensions: length 22.1 m (72.5 ft); beam 5.94 m (19.5 ft); draught 1.68 m (5.5 ft)
Propulsion: three petrol engines delivering 2983 kW (4,000 bhp) to three shafts
Speed: 40 kts
Endurance: 463 km (288 miles) at 40 kts
Armament: two 533-mm (21-in) torpedoes, and various combinations of 6-pdr gun, 20-mm cannon, and 12.7-mm (0.5-in) and 7.7-mm (0.303-in) machine-guns
Complement: 12 or 13

MTB 80 ***was one of the first of Vosper's 72.2-footers. The class was to give excellent service when fitted with 6 pdrs and 20-mm cannon, but the original armament of two 12.7-mm (0.5-in) and four 7.7-mm (0.303-in) MGs was not adequate (as was unfortunately proven when MTB 80 was lost in 1941).***

UK

Fairmile 'D' type

Practical pre-war experience demonstrated that MTBs would probably find difficulty in penetrating a determined escort to reach a target, particularly if that escort was of 'E-boats'. What was required was a more heavily armed, but still fast craft to occupy the latter's attentions, to defend the MTBs and allow them to concentrate on the main objectives. A further requirement was the need to defend convoys against E-boats in the absence of a destroyer escort. As already related, a few of the available BPB 'Masby' boats were rearmed to serve temporarily but, for the long term, the **Fairmile 'D' type** and the steam gunboat were developed.

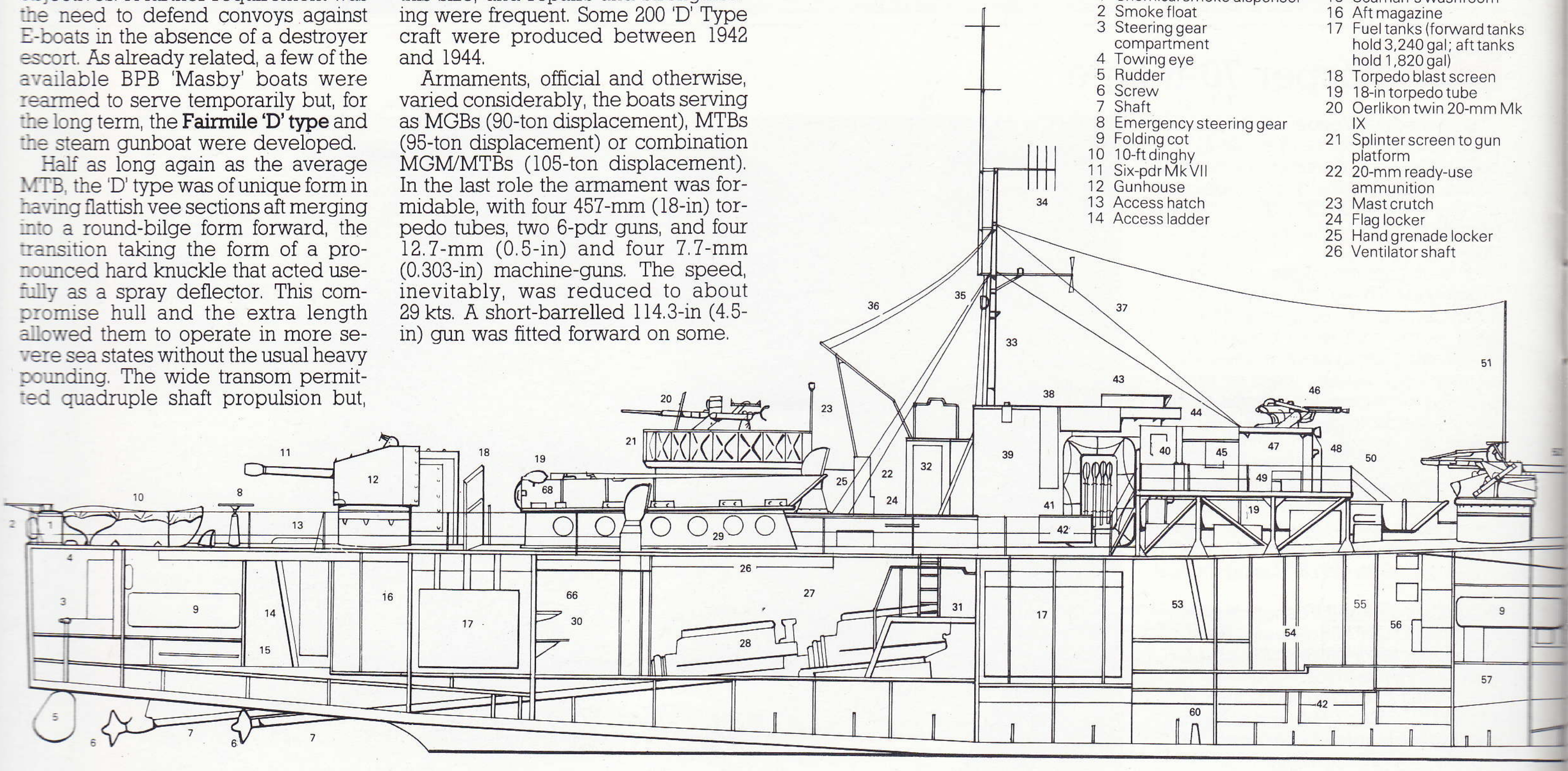
Half as long again as the average MTB, the 'D' type was of unique form in having flattish vee sections aft merging into a round-bilge form forward, the transition taking the form of a pronounced hard knuckle that acted usefully as a spray deflector. This compromise hull and the extra length allowed them to operate in more severe sea states without the usual heavy pounding. The wide transom permitted quadruple shaft propulsion but, where this decreased the draught as a result of smaller-diameter propellers, it was due more to the power of available engines than design requirements. Early craft had direct drive but gearboxes were later introduced, improving both efficiency and speed. Hard driving exposed the weaknesses of mass-producing an all-wood craft of this size, and repairs and strengthening were frequent. Some 200 'D' Type craft were produced between 1942 and 1944.

Armaments, official and otherwise, varied considerably, the boats serving as MGBs (90-ton displacement), MTBs (95-ton displacement) or combination MGM/MTBs (105-ton displacement). In the last role the armament was formidable, with four 457-mm (18-in) torpedo tubes, two 6-pdr guns, and four 12.7-mm (0.5-in) and four 7.7-mm (0.303-in) machine-guns. The speed, inevitably, was reduced to about 29 kts. A short-barrelled 114.3-in (4.5-in) gun was fitted forward on some.

Because of their size (and endurance when fitted with auxiliary tanks) Shetland-based 'D' types were able to work the Norwegian coast and, operating out of Malta and Bône, to add to the misery heaped on the Afrika Korps' supply convoys. Against the low-profile E-boats, they possessed the great advantage of radar.

Fairmile 'D' MTB 1944 cutaway drawing key

1 Chemical smoke dispenser
2 Smoke float
3 Steering gear compartment
4 Towing eye
5 Rudder
6 Screw
7 Shaft
8 Emergency steering gear
9 Folding cot
10 10-ft dinghy
11 Six-pdr Mk VII
12 Gunhouse
13 Access hatch
14 Access ladder
15 Seaman's washroom
16 Aft magazine
17 Fuel tanks (forward tanks hold 3,240 gal; aft tanks hold 1,820 gal)
18 Torpedo blast screen
19 18-in torpedo tube
20 Oerlikon twin 20-mm Mk IX
21 Splinter screen to gun platform
22 20-mm ready-use ammunition
23 Mast crutch
24 Flag locker
25 Hand grenade locker
26 Ventilator shaft



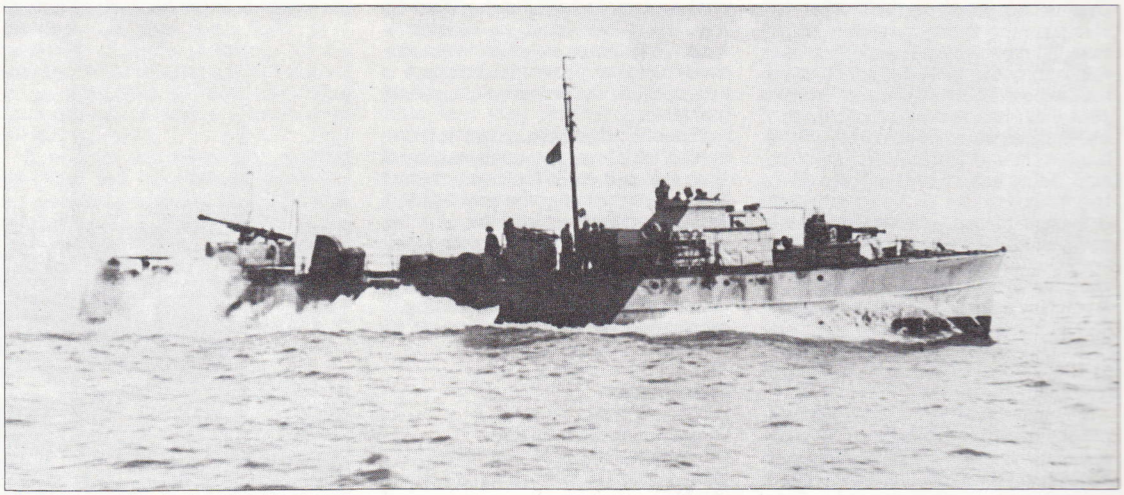
UK

Fairmile 'A' and 'C' types

So well associated with the construction of coastal craft did the name of Fairmile become that it is, perhaps, suprising to discover that it began operations as late as 1939. It convinced the Admiralty of the need for a motor launch (ML) along the lines of those that served during World War I. These had been built in the USA and, mainly through lack of length, were not totally satisfactory in service. Fairmile proposed to increase length substantially from 22.85-24.37 m (75-80 ft) to 33.53 m (110 ft) and to gear up to an extended programme by prefabrication. Thus, in place of a yard framing up a boat, planking it and fitting it out in the traditional (and slow) manner a variety of wood-working companies, not necessarily connected with boat building, would be involved in the series construction of component parts. These, made from standard jigs, would then be assembled rapidly in the actual waterside yard, even the planking being supplied in ready-to-assemble numbered sets.

To test the system, the Admiralty ordered 12 **Fairmile 'A' type** craft, numbered ***ML100-111***. They were, indeed, produced rapidly in 1940, but the design itself was found to be less than ideal. It had been developed for general inshore patrol and auxiliary duties, an asdic (sonar) set and 12 depth charges being carried as standard. In practice, the design's hard-chine form tended to pound in a seaway and throw spray. More seriously, the bunker capacity for the three Hall Scott petrol engines was far too small. For the long wartime production runs, therefore, a new design known as the Fairmile 'B' type was produced.

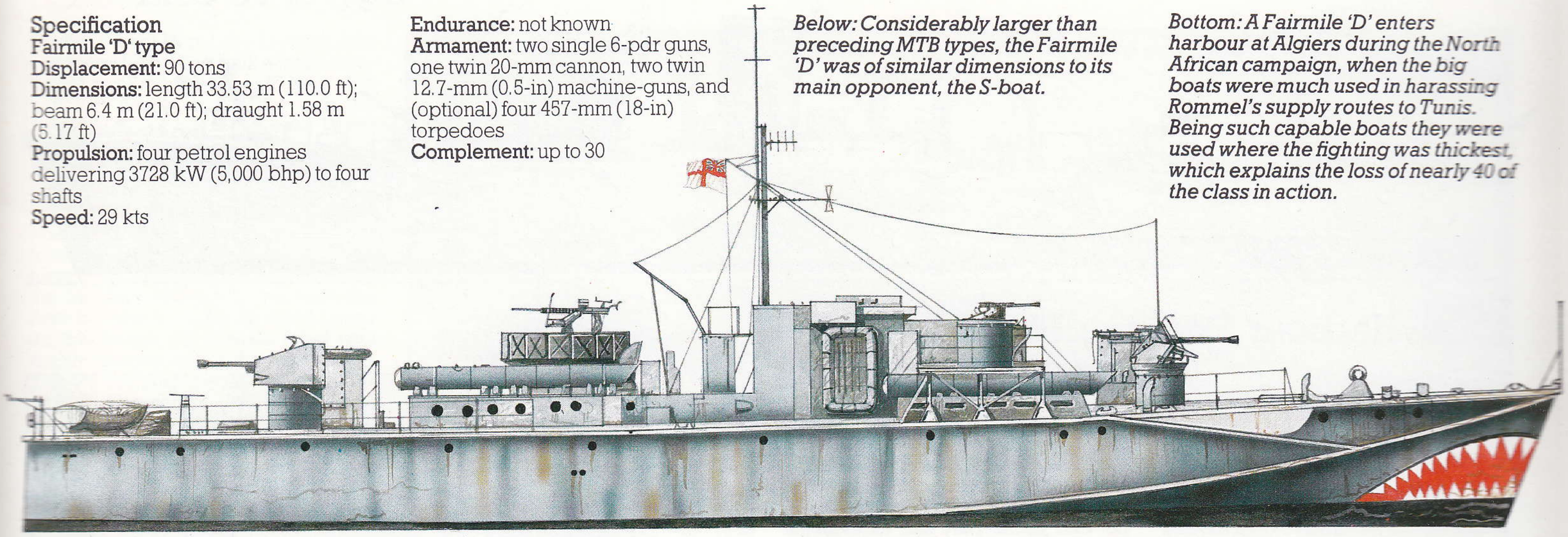
The initial 12 'A' type boats were later converted into inshore minelayers, with a capacity of up to nine mines each. During the invasion scare of 1940, motor gun boats (MGBs) were needed urgently and the 'A' type jigs were used to construct 24, known as the **Fairmile 'C' type**. These had supercharged engines and better laid out topsides, MTB-style, with an enhanced armament of two 2-pdr guns and two twin 12.7-mm (0.5-in) machine-guns.



A Fairmile 'C' MGB with the original armament of two 2-pdrs and two pairs of 12.7-mm (0.5-in) MGs makes her way at close to her maximum speed of 25 kts. Slower but larger than standard MGBs, the Fairmiles were also up-gunned, with up to six 20-mm cannon being shipped.

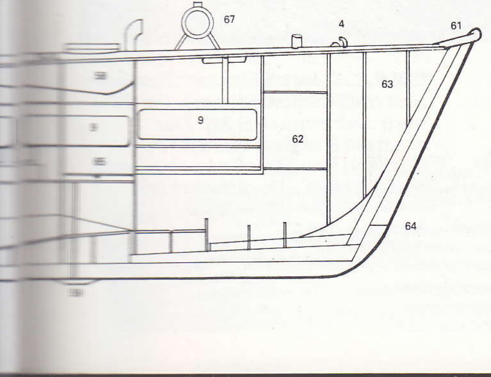
Specification
Fairmile 'A' type
Displacement: 58 tons
Dimensions: length 33.53 m (110.0 ft); beam 5.31 m (17.42 ft); draught 1.83 m (6.0 ft)
Propulsion: three petrol engines delivering 1342 kW (1,800 bhp) to three shafts
Speed: 22 kts
Endurance: not known
Armament: one 3-pdr gun, and two 7.7-mm (0.303-in) machine-guns
Complement: 16

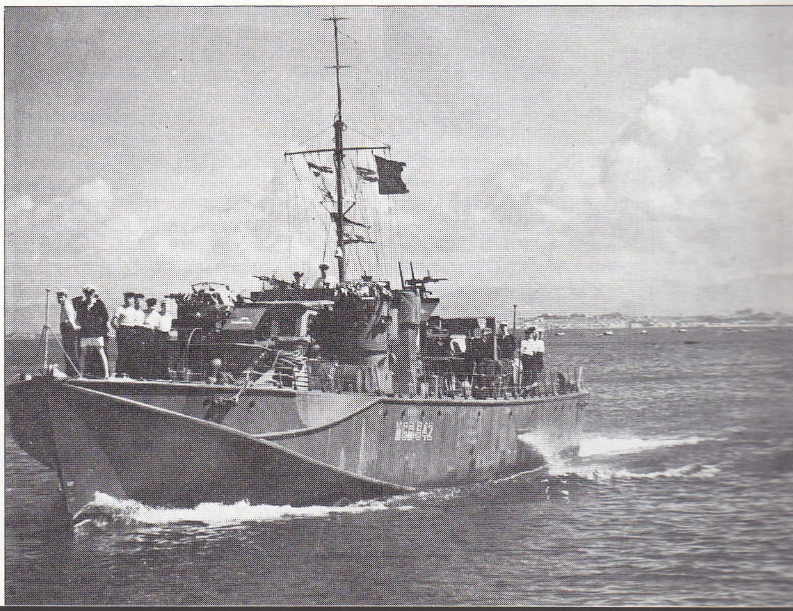
Specification
Fairmile 'D' type
Displacement: 90 tons
Dimensions: length 33.53 m (110.0 ft); beam 6.4 m (21.0 ft); draught 1.58 m (5.17 ft)
Propulsion: four petrol engines delivering 3728 kW (5,000 bhp) to four shafts
Speed: 29 kts
Endurance: not known
Armament: two single 6-pdr guns, one twin 20-mm cannon, two twin 12.7-mm (0.5-in) machine-guns, and (optional) four 457-mm (18-in) torpedoes
Complement: up to 30



Below: Considerably larger than preceding MTB types, the Fairmile 'D' was of similar dimensions to its main opponent, the S-boat.

27 Engine room
28 Packard petrol 12-cylinder 1,250-hp engine (four)
29 Torpedo tube support frame
30 Work benches
31 Platform
32 Compass platform
33 Mast
34 Radar Type 291 or 242
35 Loud hailer
36 TW 12 aerial
37 TCS aerial
38 Bridge
39 Wheel house
40 Radar office
41 Pattern 23 liferaft
42 Fresh water tank (five)
43 Windscreen
44 Wind deflector
45 Machine-gun ammunition locker
46 Twin Vickers 0.303-in machine-guns (each side of bridge)
47 Power mounting
48 2-in rocket flares
49 Catwalk
50 Oilskin locker
51 Mast aerial
52 Open six-pdr Mk VII
53 Wardroom
54 Outer hull frames to hard chine hull
55 Lobby
56 CO's cabin
57 Forward magazine/shell room
58 Recessed scoop in hull
59 Type 715A hydrophone
60 Pitometer log
61 Stem eye
62 Crew's WC
63 Forepeak
64 Waterline
65 Electric heater
66 Aft machine stores
67 Anchor windlass
68 Explosion chamber to torpedo tube





Bottom: A Fairmile 'D' enters harbour at Algiers during the North African campaign, when the big boats were much used in harassing Rommel's supply routes to Tunis. Being such capable boats they were used where the fighting was thickest, which explains the loss of nearly 40 of the class in action.

UK

Fairmile 'B' type

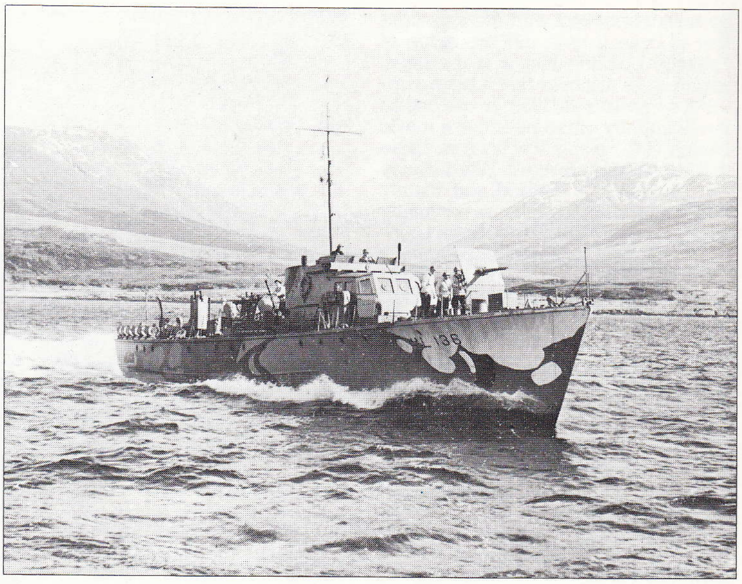
One of the most versatile types of warship ever to see service, the **Fairmile 'B" type** motor launch (ML) was also one of the most numerous, some 670 being built in all between 1940 and 1944. The lines, in contrast with those of the 'A' type, were of a seakindly round-bilge form and were of Admiralty design, being turned over to Fairmile for the preparation of constructional drawings to suit a mass production programme. A large number of yards were involved in the construction, ranging in the UK from Sheerness Royal Naval Dockyard to Southampton Steam Joinery, and all over the Commonwealth from Vancouver Shipyard to the Anglo-American Nile Tourist Company at Cairo.

The initial requirement was for a triple-screwed craft, but the Hall Scott petrol engines specified were in short supply and only two were ever fitted, incurring a speed penalty of 4 to 5 kts. Their legend armament was a 3-pdr gun, two 7.7-mm (0.303-in) Lewis guns and a dozen depth charges (supported by an asdic set) but in practice they took a bewildering variety of fits. Torpedo tubes were removed from the Lease-Lend flush-deck destroyers and fitted to some, making them the world's only 20-kt MTBs, a measure of the desperate stop gaps adopted in 1940. They served as gunboats, air-sea rescue boats, AS patrol boats, inshore magnetic and acoustic minesweepers, smokelayers, hospital boats and convoy escorts, for which duty they sailed on their own bottoms to the West Indies, West Africa and the Mediterranean. Hulls were supplied with standard fittings to allow rapid change of armament or the shipping of auxiliary fuel tanks.

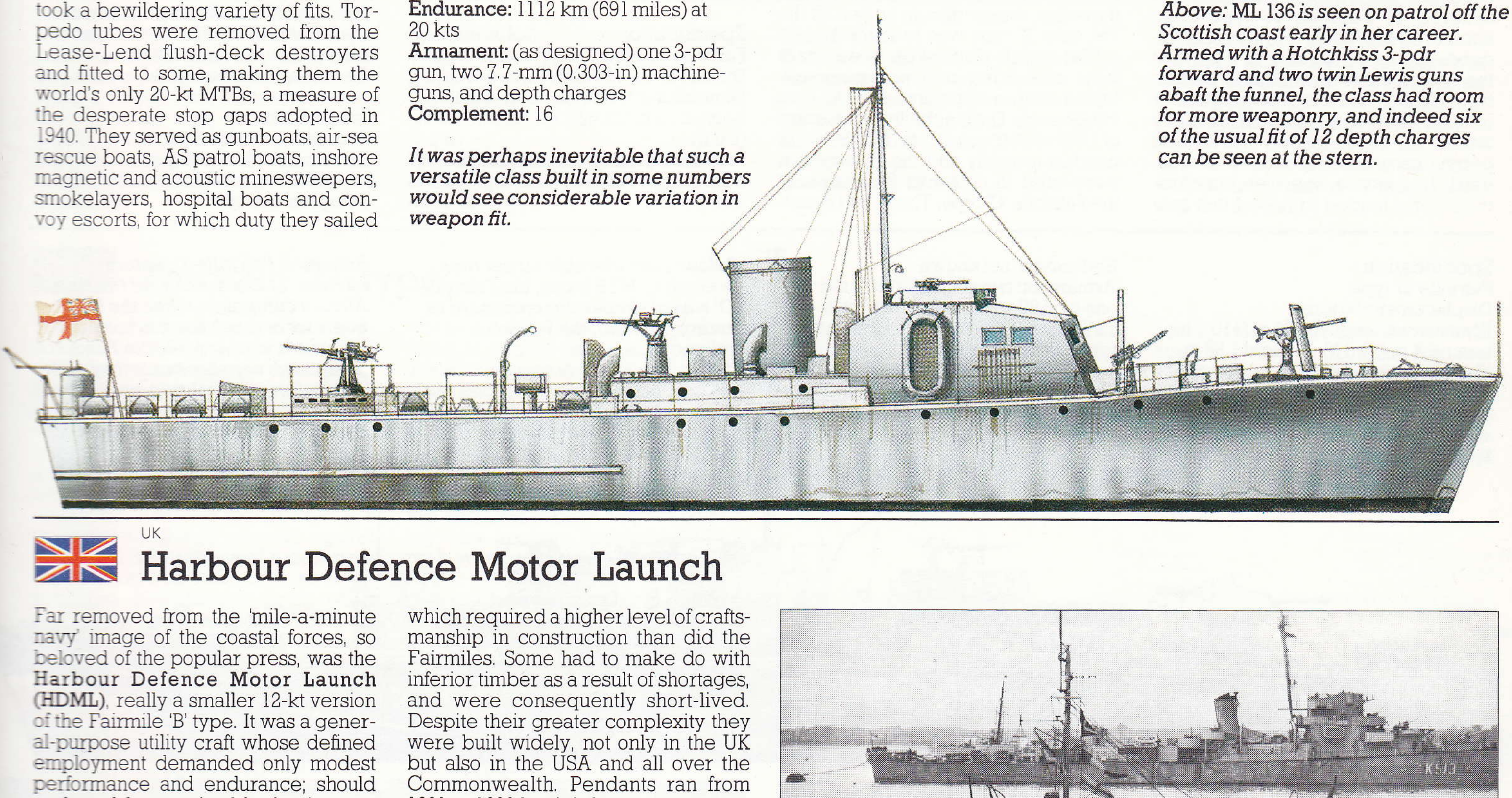
Probably the best-known involvement of MLs in an operation was that of 16 in the raid on St Nazaire in March 1942, the situation of the port inside a well-defended estuary demanding shoal-draught vessels. In fighting their way both in and out, landing and recovering the commandos they carried, 12 were destroyed, some needing to be scuttled during the retirement for damage received.

Specification

Fairmile 'B' type
Displacement: 67 to 85 tons
Dimensions: length 34.14 m (112.0 ft); beam 5.56 m (18.25 ft); draught 1.52 m (5.0 ft)
Propulsion: two petrol engines delivering 895 kW (1,200 bhp) to two shafts
Speed: 20 kts
Endurance: 1112 km (691 miles) at 20 kts
Armament: (as designed) one 3-pdr gun, two 7.7-mm (0.303-in) machine-guns, and depth charges
Complement: 16



Above: ML 136 *is seen on patrol off the Scottish coast early in her career. Armed with a Hotchkiss 3-pdr forward and two twin Lewis guns abaft the funnel, the class had room for more weaponry, and indeed six of the usual fit of 12 depth charges can be seen at the stern.*



It was perhaps inevitable that such a versatile class built in some numbers would see considerable variation in weapon fit.

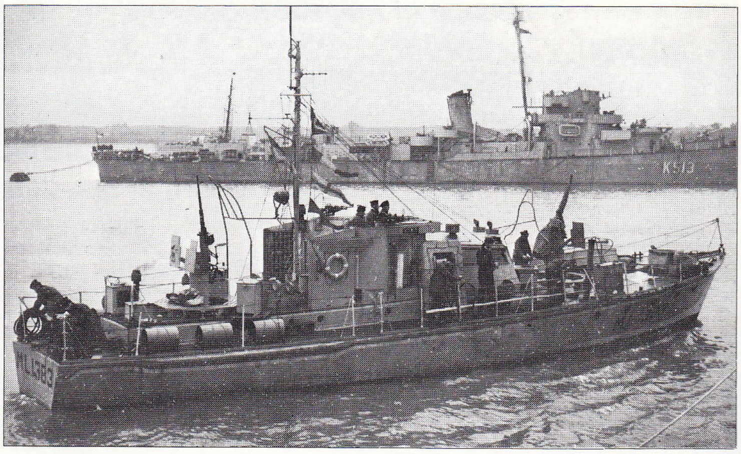
UK

Harbour Defence Motor Launch

Far removed from the 'mile-a-minute navy' image of the coastal forces, so beloved of the popular press, was the **Harbour Defence Motor Launch (HDML)**, really a smaller 12-kt version of the Fairmile 'B' type. It was a general-purpose utility craft whose defined employment demanded only modest performance and endurance; should such craft be required for foreign service they were to be shipped as deck cargo. War, as ever, changed all that.

It was widely assumed before World War II that the immediate approaches to ports would, somehow, be infested with submarines and it was in ASW that the craft was generally planned to be used. They were equipped with a small asdic (sonar) set and eight depth charges, though the combination of little or no live practice allied to immense enthusiasm, shallow water and low speed suggests that the HDML would have been at greater hazard than a U-boat!

For the low propulsive powers required, small diesels did exist from British manufacturers, and a boat's maximum speed varied according to which type she had fitted. The HDMLs were double-planked on bent frames, which required a higher level of craftsmanship in construction than did the Fairmiles. Some had to make do with inferior timber as a result of shortages, and were consequently short-lived. Despite their greater complexity they were built widely, not only in the UK but also in the USA and all over the Commonwealth. Pendants ran from 1001 to 1600 but it is by no means certain that all of these were actually issued. They were lovely craft to handle, seakindly and responsive with their double rudders. Employed in large numbers in every theatre, they travelled on their own bottoms as far afield as Iceland. One flotilla, required for use in the West Indies, was fitted with temporary sailing rig to assist fuel economy on the long transatlantic leg; though sailing was demonstrably feasible, the craft were re-allocated to the North African landing forces. They worked also as inshore minesweepers, despatch boats and (radar-fitted) as navigation markers for major amphibious operations.



HDML 1383 *leaves Harwich harbour past HMS* Curzon *(formerly the US destroyer escort DE-84). This example is armed with a 20-mm Oerlikon fore and aft and twin Lewis guns on each side of the bridge.*

Specification

Harbour Defence Motor Launch
Displacement: 54 tons
Dimensions: length 21.95 m (72.0 ft); beam 4.82 m (15.83 ft); draught 1.68 m (5.5 ft)
Propulsion: two diesels delivering 239 kW (320 bhp) to two shafts
Speed: 12 kts
Endurance: not known
Armament: one 3-pdr gun, one 20-mm cannon, and two 7.7-mm (0.303-in) machine-guns
Complement: 10

UK

Steam Gun Boat

Developed in parallel with the Fairmile 'D's type was the **Steam Gun Boat (SGB)**, a type which at over 44-m (144.4-ft) length was viewed as virtual 'Queen Marys' by the coastal forces. The first of class commenced trials in November 1941, some three months ahead of the first 'D' type. The concept existed at all only as a typically British solution to a problem that should not have existed in the first place, i.e. the lack of a suitable indigenous small diesel engine. Steam plant had the advantage of quietness but, even with the most compact twin-screw plant drawing steam from a single boiler, it demanded a large hull which while having the disadvantage of being a larger target was a positive factor for seakeeping, in which the E-boat was acknowledged to be excellent.

Wooden hulls of this size were not feasible for mass production and steel was used. Unfortunately this meant that both hulls and machinery were now beyond the scope of the small yards engaged in the rapid expansion of the coastal forces, and the SGB thus competed for berths in yards hard put to produce urgently required convoy escorts. Of the 60 planned, therefore, it is not surprising that only nine were ordered, and of these but seven completed, in 1941-2.

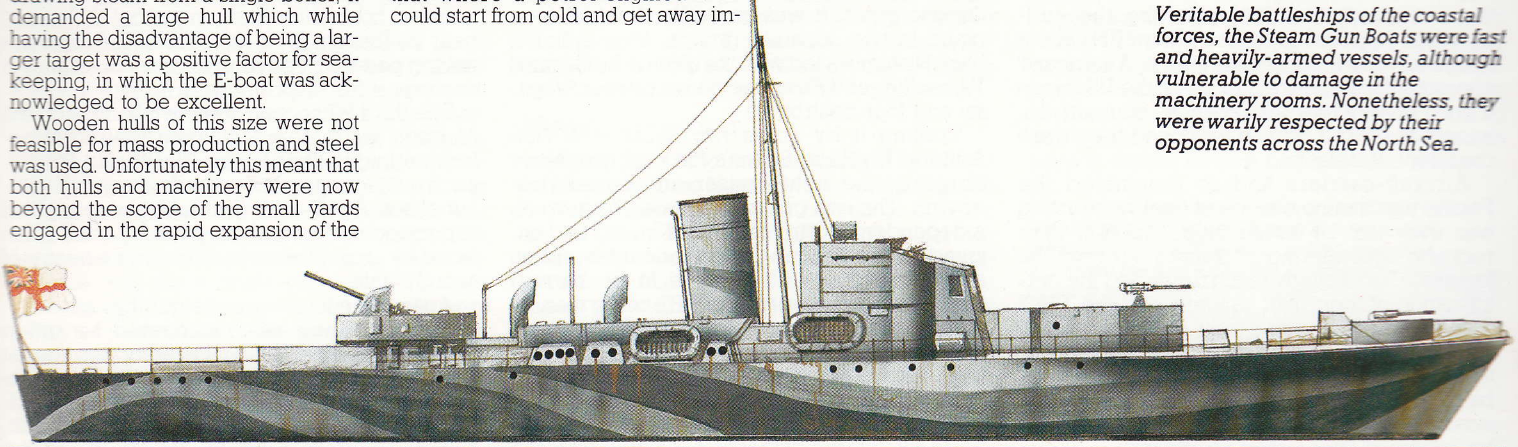
In practice the steam plant proved complex and vulnerable, with initial troubles concentrated on insufficient energy being delivered by the boiler and heavily-cavitating propellers. Even when these problems were cured, fuel consumption remained heavy, with the added disadvantage that where a petrol-engined boat could start from cold and get away immediately, an SGB had to remain in steam, using a considerable amount of fuel and man hours in the process.

In action, however, the E-boat commanders respected the SGBs only a little less than destroyers, as they could pounce unexpectedly and hold their speed in a seaway. They proved excessively vulnerable to action damage in the machinery spaces, and the necessary addition of 18-mm (0.7-in) protective plate added much weight. More armament and crew increased displacement further and service speed was eventually reduced to only 30 kts.

Specification

Steam Gun Boat
Displacement: 165 tons
Dimensions: length 44.42 m (145.75 ft); beam 6.1 m (20.0 ft); draught 1.68 m (5.5 ft)
Propulsion: two sets of geared steam turbines delivering 5965 kW (8,000 shp) to two shafts
Speed: 35 kts
Endurance: not known
Armament: (final arrangement) one 76.2-mm (3-in) gun, two single 6-pdr guns, and two twin 20-mm cannon
Complement: 27

Veritable battleships of the coastal forces, the Steam Gun Boats were fast and heavily-armed vessels, although vulnerable to damage in the machinery rooms. Nonetheless, they were warily respected by their opponents across the North Sea.

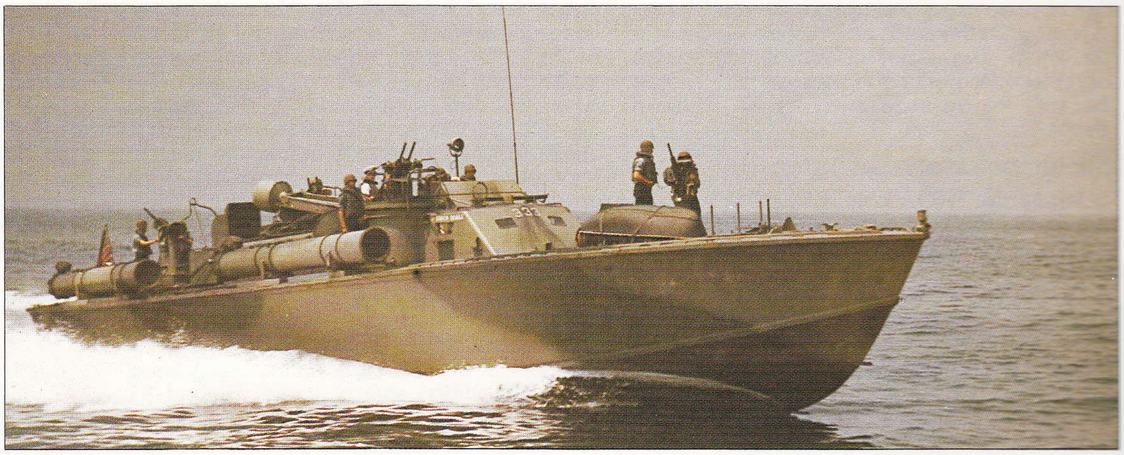


USA

Elco 80-ft type

During World War I the Electric Boat Company (Elco) had built a large number of small craft for the US Navy, but had lost design continuity with the navy's post-war lack of interest. When an official competition was announced in the late 1930s, therefore, Elco acquired from the British Power Boat Company a state-of-the-art European boat in a 21.34-m (70-ft) private venture, armed with four 457-mm (18-in) torpedoes. Elco succeeded in getting the US Navy not only to purchase the boat but also to order 23 more based on the design, 12 of them fitted with depth charges rather than torpedoes. The PT versions began to enter service in November 1940. They were viewed as experimental and, though satisfactory, it was recommended that further boats incorporate standard Packard petrol engines and 533-mm (21-in) torpedo tubes. This necessitated an increase in length to 23.47 m (77 ft). Five were thus constructed for the competition in 1941, and the 70-footers were transferred to the UK under Lend-Lease terms.

In the play-off the Elco boats did well, returning high speeds with good manoeuvrability. On the other hand, they slammed worse than the others and suffered minor structural failures that required design modification. Extra length was also recommended for improved seaworthiness and habitability; as the specification put the maximum at 25 m (82 ft), Elco went to 24.38 m (80-ft). By then the USA was at war and Elco had already constructed four squadrons of 77-footers which still carried the non-preferred 457-mm (18-in) torpedoes. All told, 358 Elco 80-footers were constructed, the three Packard engines giving them an edge in speed over their similarly-powered Higgins running mates. Of the two, the Elco was the preferred design but suffered as a result of its extra reserve displacement, resulting from its length, being bought up by additional equipment. This was partially offset by the Packard engine being progressively uprated in power.

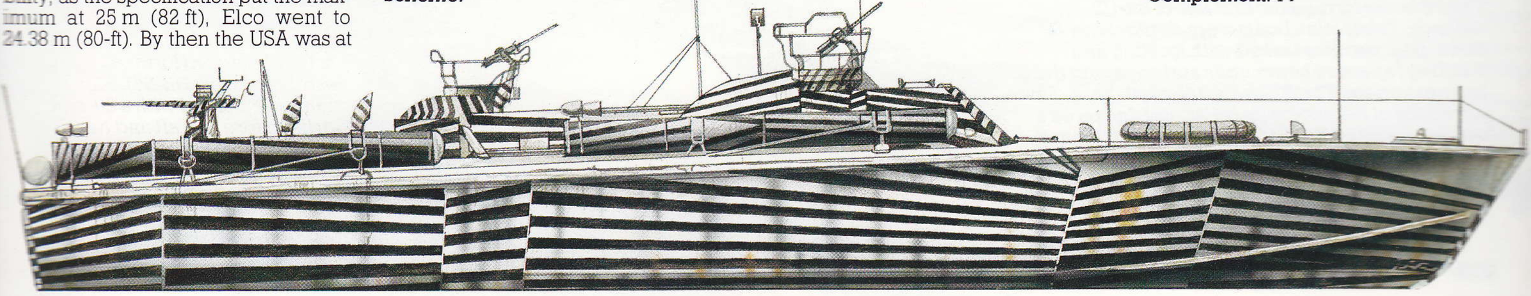


Elco PT Boats were expanded versions of the original Hall-Scott design, with room for four torpedoes and a wide variety of guns.

Specification

Elco 80-ft type
Displacement: 38 tons
Dimensions: length 24.38 m (80.0 ft); beam 6.32 m (20.75 ft); draught 1.52 m (5.0 ft)
Propulsion: three petrol engines delivering 3020 kW (4,050 bhp) to three shafts
Speed: 40 kts
Endurance: not known
Armament: (typical) four 533-mm (21-in) torpedoes, one 40-mm gun, one 20-mm cannon, and four 12.7-mm (0.5-in) machine-guns
Complement: 14

A 1944 experiment saw an Elco boat painted in this startling dazzle scheme.



The Battle of the Surigao Strait

Surigao Strait is remembered as the last battleship-versus-battleship action in history, as well as being one part of the titanic clash known as the Battle of Leyte Gulf. What is less well known is the valuable contribution to the destruction of Nishimura's force that was made by the PT boats of the US Navy.

On 20 October 1944 the Americans started a major landing on the island of Leyte. It had two major objectives: to launch the reconquest of the Philippines and to provoke the still-powerful Imperial Japanese Navy (IJN) into a final showdown on ground of the Americans' choosing. Intelligence had given the US forces a good idea of how the Japanese counterplan, known as 'SHO-1', would work and they were confident of defeating it.

Aircraft-carriers had so dominated the Pacific war that no chance of their destruction was ever lost by either side. Through their reckless squandering of trained aircrew, the Japanese had already much degraded the performance of their own carriers, and the 'SHO' plan hinged upon using their remaining flight-decks as an irresistible lure to the Americans who, having left their landing denuded of cover by their pursuit, would have it destroyed by a synchronized attack by surface forces covered by Japanese land-based air power.

In the event Leyte, the chosen site, suited the plan's purpose admirably, the sheltered waters of its gulf being approachable from the west by two major waterways, the San Bernardino Strait to the north and the Surigao Strait to the south. The series of actions consequent upon Japanese efforts to wipe out the landing became known collectively as the Battle of Leyte Gulf.

Simultaneous attacks

Briefly, the 'SHO-1' plan initiated on 10 October was to use Vice Admiral Jisaburo Ozawa's carrier group to seduce Vice Admiral William F. Halsey's 3rd fleet from its offshore station and then to attack the gulf simultaneously from both north and south, overcoming resistance from Vice Admiral Thomas S. Kinkaid's weaker 7th Fleet by a combination of surprise and sheer strength. The Japanese San Bernardino group (or Northern Force) under Vice Admiral Takeo Kurita, including the world's mightiest battleships, *Musashi* and *Yamato*, was sighted and savaged by Halsey's seaborne air power throughout 23 and 24 October during its transit of the Sibuyan Sea. At 17.00 on 24 October, however, Ozawa's carriers (the Strike Force) were sighted. The impetuous Halsey took the whole 3rd Fleet north in pursuit, leaving a wounded but resolute Kurita still coming and the Strait unguarded. Already delayed, the latter transitted the Strait but ran into an American escort carrier group which, by 'bold face' tactics and conspicuous bravery, turned Kurita back in the wild action off Samar.

This is to anticipate, for the Japanese Southern Force, similarly attacked over its long approach, was shaping up to burst through the Surigao Strait. It was an oddly divided command in two separate groups. Vice Admiral Shoji Nishimura led with the elderly battleships *Yamashiro* and *Fuso*, the heavy cruiser *Mogami* and four destroyers.

Trailing it by about two hours was Vice Admiral Kiyohide Shima's force of two heavy cruisers, one light cruiser and seven destroyers. The two groups appeared to have an independent existence, while Kinkaid had enjoyed adequate time to plan their interception and discomfiture. They were to be harried throughout their approach by PT boats, then by destroyers, each using the night torpedo attacks practised so well by the Japanese themselves. Any enemy that penetrated this gauntlet-run would find itself met by the armoured wall of Rear Admiral Jesse Oldendorf's six veteran battleships, backed by three heavy and five light cruisers, plus 29 destroyers.

No less than 42 PT boats waited in the area, newly-arrived and chafing through earlier underemployment. With little night air reconnaissance available, their task was to find, track, report and to attack on opportunity. The 39 boats available on the day were organized into 13 three-boat sections covering 113 km (70 miles) from Bohol Island, across the eastern Mindanao Sea and up the southern half of the crucial Surigao Strait.

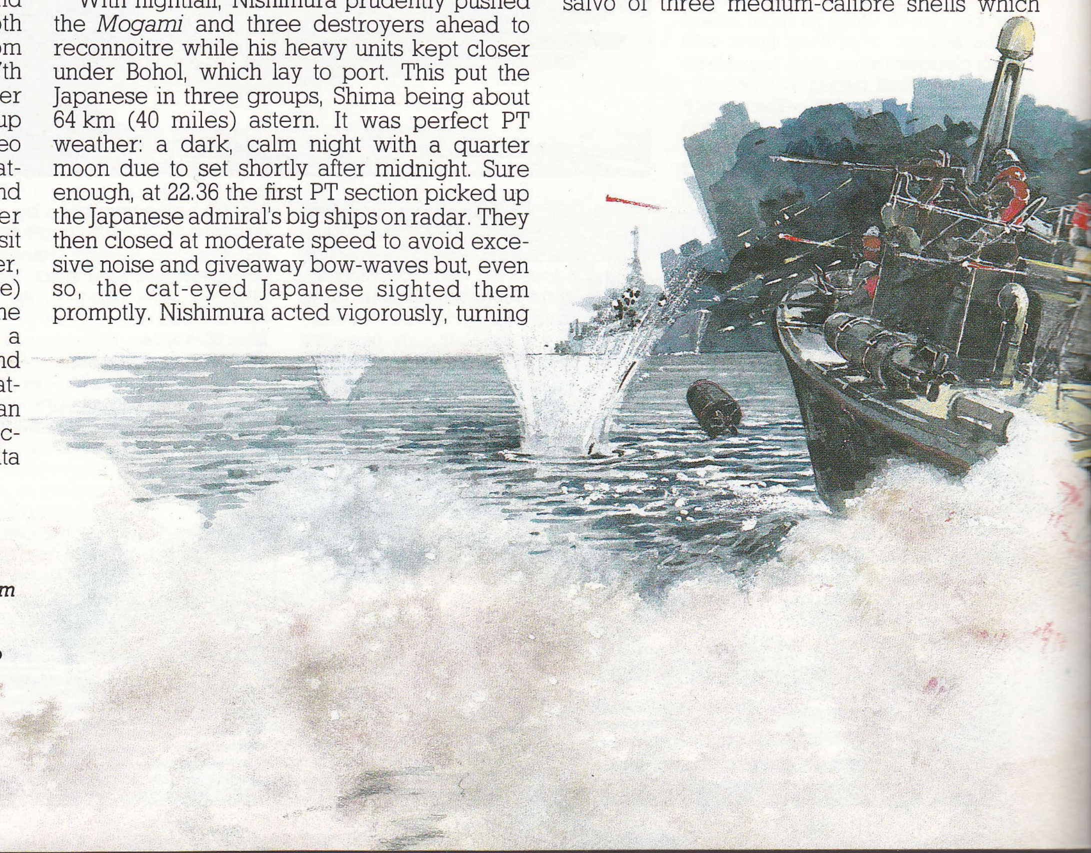
Three Japanese groups

With nightfall, Nishimura prudently pushed the *Mogami* and three destroyers ahead to reconnoitre while his heavy units kept closer under Bohol, which lay to port. This put the Japanese in three groups, Shima being about 64 km (40 miles) astern. It was perfect PT weather: a dark, calm night with a quarter moon due to set shortly after midnight. Sure enough, at 22.36 the first PT section picked up the Japanese admiral's big ships on radar. They then closed at moderate speed to avoid excessive noise and giveaway bow-waves but, even so, the cat-eyed Japanese sighted them promptly. Nishimura acted vigorously, turning toward the midget vessels and using searchlights and rapid-fire medium-calibre guns in textbook fashion. The Americans were young and inexperienced, and their attack wilted under this riposte. *PT-152* had her forecastle peppered by a contact burst that blew forward gun and gunner into oblivion. Her running mate, *PT-130*, rushed in with smoke only to be pierced herself by a projectile that did not explode. None of the section gained an attacking position; neither, more importantly, did they make a contact report. Worse, the *Mogami* group had passed the second section without either side being aware of the other. Not until two hours after first contact did Oldendorf hear of the enemy's approach, the message having passed by several relays. Fortunately it confirmed his dispositions.

The third PT section, meanwhile, took on the *Mogami* group near Limasawa Island just before midnight. Two boats, *PT-146* and *PT-151*, each managed to get a torpedo away, but without effect. Again they were obliged to hightail it, pursued in their snaking paths by a hail of fire laced by arcs of tracer and blue white beams of searchlights.

Again no contact reports got through.

Nishimura now re-concentrated his group the better to meet this scattered opposition. At this point he held the initiative and sent a confident progress report to Kurita who was heading for the San Bernardino Strait to the north, though much delayed by air attacks in the Sibuyan Sea. Shortly before 02.00 he was passing the narrows between Pananon and the northern tip of Mindanao, beyond which he would turn northward up the strait. In this 16-km (10-mile) wide chokepoint no less than five sections of PTs were concentrated. These succeeded in closing piecemeal to the point where about a dozen torpedoes were expended, again without result. It was in this dazzling, deafening confusion that the PTs suffered their first real casualty, *PT-490* being badly hit while pressing in to deliver a pair of torpedoes. *PT-493* saw her predicament and closed to assist and lay smoke. As she did she received a salvo of three medium-calibre shells which



The PT boats formed the first line of the US defence. Thirty-nine boats were deployed in 13 three-boat sections tasked with locating and tracking Japanese heavy units and engaging them as appropriate. The PT boats detected the approach of the enemy by radar and delivered a series of attacks, but it took two hours for them to inform Rear Admiral Oldendorf, commander of the US battleship squadron.

caused severe casualties, removed most of her upperworks and badly holed the hull. She beached successfully but later slid off and foundered.

Triumphantly, Nishimura held course, having proved again that torpedo attack by small craft needs the advantage of surprise. Only two sections of PT boats were now left ahead of him, and both these were ordered to stand clear for the planned destroyer attacks. The time was 02.15 on 25 October; Shima was closing astern and Kurita had passed the unguarded San Bernardino Strait almost two hours before. At this point Leyte Gulf was in dire danger.

Though the little ships had enjoyed scant reward for their effort so far, they had marked the Japanese onward progress to the yard and, paradoxically, engendered a measure of overconfidence in their enemy. At 03.30, however, from the dark cover of land on each side, Nishimura was attacked by destroyers. There was no warning before 27 torpedoes were away and, seemingly paralysed by indecision, the Japanese took little evasive action. Both battleships and three destroyers were hit, one blowing up. A second wave of six destroyers followed immediately. The *Yamashiro* was hit again but pressed on; the already stricken *Fuso* blew into two separate halves which remained afloat for a while. A further destroyer disintegrated. Nishimura's force was already shattered, only the flagship, the heavy cruiser *Mogami* and one destroyer proceeding but wavering. They were already coming under fire from Oldendorf's main body at the head of the strait when the third and last destroyer attack was made.

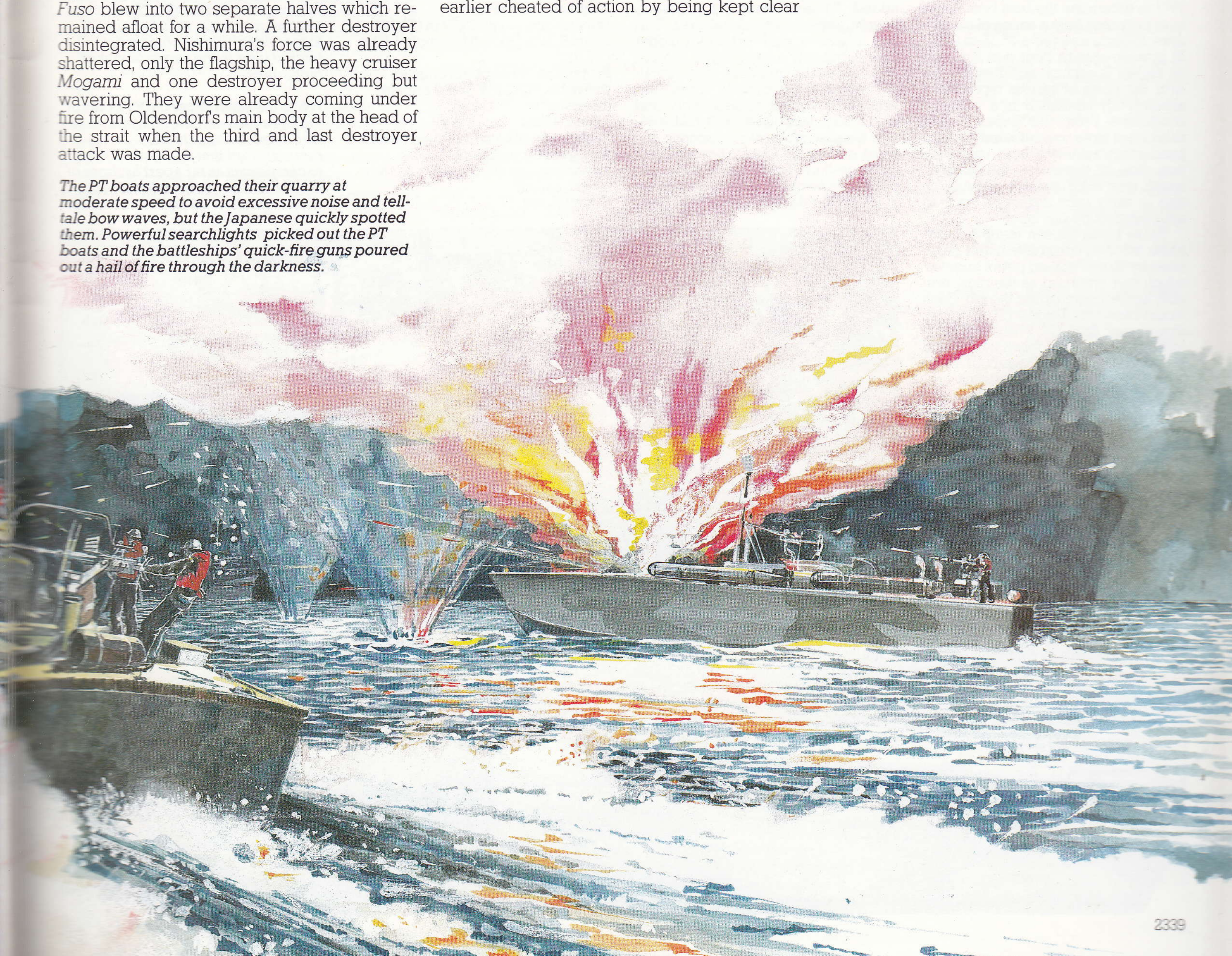
This, somewhat discomforted by 'friendly' fire, succeeded in putting two more torpedoes into the doomed *Yamashiro*, at the cost of one destroyer heavily damaged. The Japanese flagship was dismembered within nine minutes by the American heavies, but the *Mogami* and the destroyer *Shigure* turned about and ran back down the strait, only to run (literally) into Shima: the *Mogami* collided with the cruiser *Nachi* but proceeded. At this point *PT-137*, which had hung around after fruitlessly expending two torpedoes after an advancing Nishimura, saw the enemy returning and loosed a further torpedo at a destroyer. It missed but went on to disable the light cruiser *Abukuma* beyond. Shima was also now in full and sensible retreat. With a new day dawning the PTs returned to harry their withdrawal.

Mogami pursued

The dogged *Mogami* was tracked by *PT-491* for 20 minutes, the boat eventually missing with two torpedoes while under 203-mm (8-in) salvo fire at close range. *PT-137* made a further attempt, but the damaged cruiser and her sole remaining destroyer saw her off. *PT-190* at the same time enthusiastically but unwisely approached Shima's main force and was fortunate to escape, nearly in one piece. *PT-323*, earlier cheated of action by being kept clear for the destroyer attack, became separated from her section during the night and came across a burning wreck at first light. Standing by was the damaged destroyer *Asagumo*, which took the PT under hot fire, frustrating three attempts to attack. The PT's final cause for frustration was the arrival of an American cruiser/destroyer force which promptly finished off both Japanese! *PT-150* and *PT-194* unsuccessfully took on the heavy cruiser *Nachi*, the latter boat taking a 203-mm (8-in) shell hit.

The surface action was now finished, it being left to American aircraft to pick off the enemy stragglers, only two cruisers and five destroyers surviving out of the combined Southern Force. The PTs had come through their greatest test with much credit but few scalps. Interestingly, they had been repulsed mainly by that very combination of searchlights and quick-firing guns adopted by the Victorian navy to defeat its own torpedo-boat bogey.

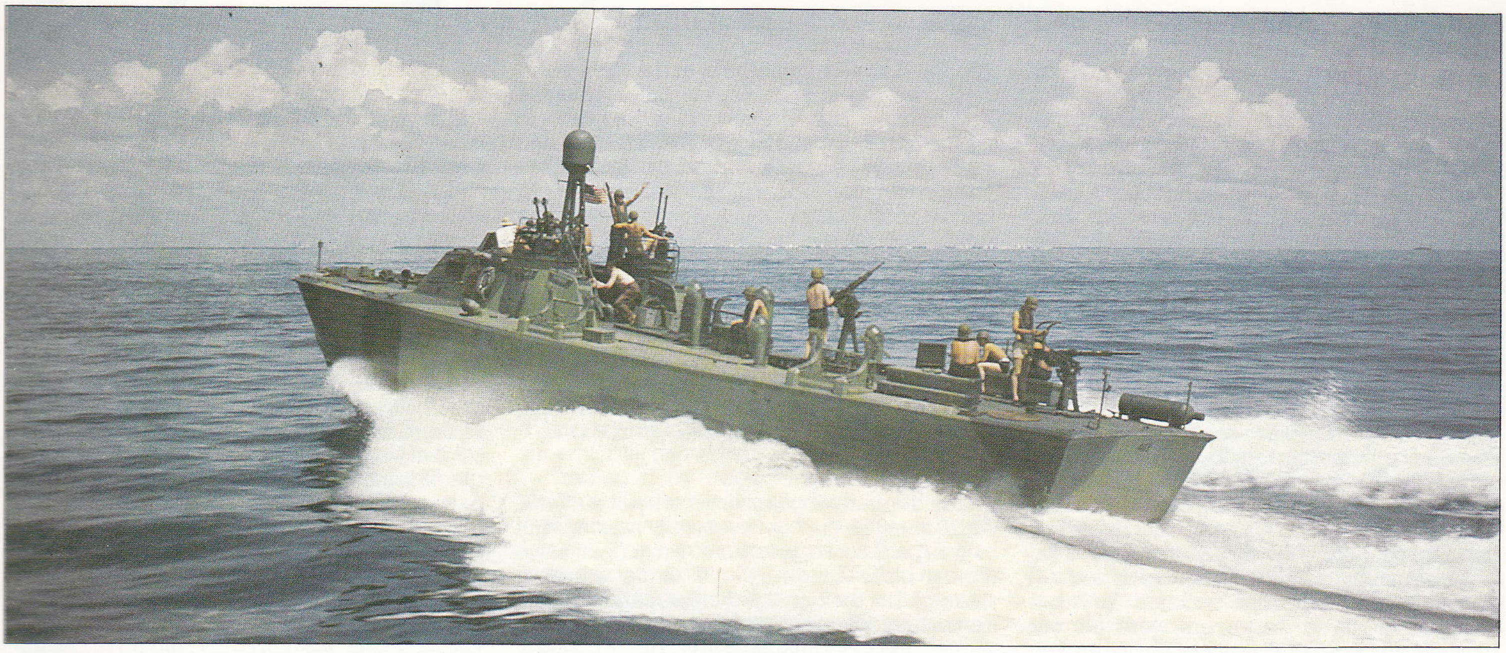
It has never been easy to apportion credit as to who torpedoed whom in a night action, and whether it was a PT boat or a destroyer that achieved the first hit on the Japanese battleships is open to question. The PT boats certainly kept the Japanese busy, but the fact remains that it was the destroyers and finally Oldendorf's battle-line that smashed the Japanese squadron to oblivion.



The PT boats approached their quarry at moderate speed to avoid excessive noise and telltale bow waves, but the Japanese quickly spotted them. Powerful searchlights picked out the PT boats and the battleships' quick-fire guns poured out a hail of fire through the darkness.

USA

Higgins 78-ft type



The **Higgins 78-ft** type had its origins in a series of trials held by the US Navy in 1941 to determine the boat best suited to its purposes from a series of contenders. Higgins entered a 25.15-m (82.5-ft) private-venture boat derived from an earlier Sparkman and Stevens design. Six boats of various types were exhaustively evaluated in a range of conditions. From this experience a short list of three was selected for mass production against a light specification. One of these was the Higgins, which was to be 'suitably reduced in size to carry such ordnance loads as are required by our Navy'.

Those boats chosen were of hard-chine wooden construction and propelled by three Packard petrol engines, which had emerged as the most reliable and economical for the job. Each would carry four 533-mm (21-in) torpedoes and four 12.7-mm (0.5-in) machine-guns. Fully laden they would be capable of 40 kts for one hour. From virtually nothing the Americans created, in a space of three years, the nucleus of a powerful force of PT boats. Two dozen (two squadrons) of Higgins' boats, now 23.77 m (78 ft) in length, were initially ordered, but these did not start to enter service until the second half of 1942 and, of these, six were transferred to the British and four to the Soviets. Eventually over 200 were constructed which, with the Elco 24.38-m (80-ft) type, were to be the US Navy's standard choices. The third type successful in the pre-war play-off, the Huckins 23.77-m (78-ft) type, was used in the training role.

Service speed, always heavily dependent upon weather conditions, deteriorated further as more and more armament and equipment were added. To assist matters a new lightweight torpedo was developed. This had a heavier warhead and a higher speed, but only a short range. It could be launched by dropping gear, obviating the need for torpedo tubes. Gun armament varied considerably and unofficially. Most later craft had a 40-mm weapon aft, a 20-mm cannon forward and up to five 12.7-mm (0.5-in) machine-guns. Some landed their torpedoes in favour of more guns for use in an MGB role against the Japanese.

Specification

Higgins 78-ft type

Displacement: 35 tons

Dimensions: length 23.77 m (78.0 ft); beam 6.32 m (20.75 ft); draught 1.52 m (5.0 ft)

Propulsion: three petrol engines delivering 3356 kW (4,500 bhp) to three shafts

Speed: 41 kts

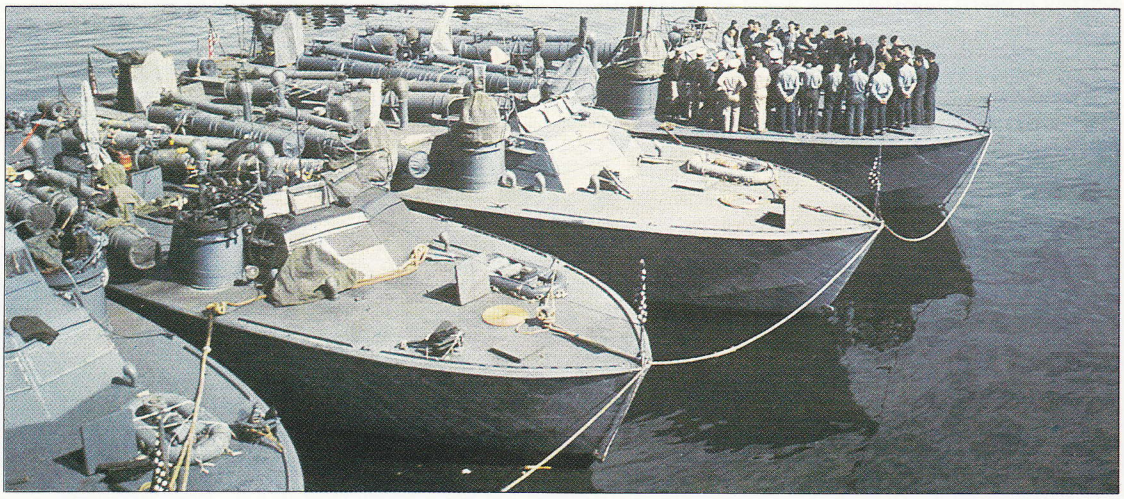
Endurance: 555 km (345 miles) at 41 kts

Armament: four 533-mm (21-in) torpedoes, one 40-mm gun, and two 20-mm cannon

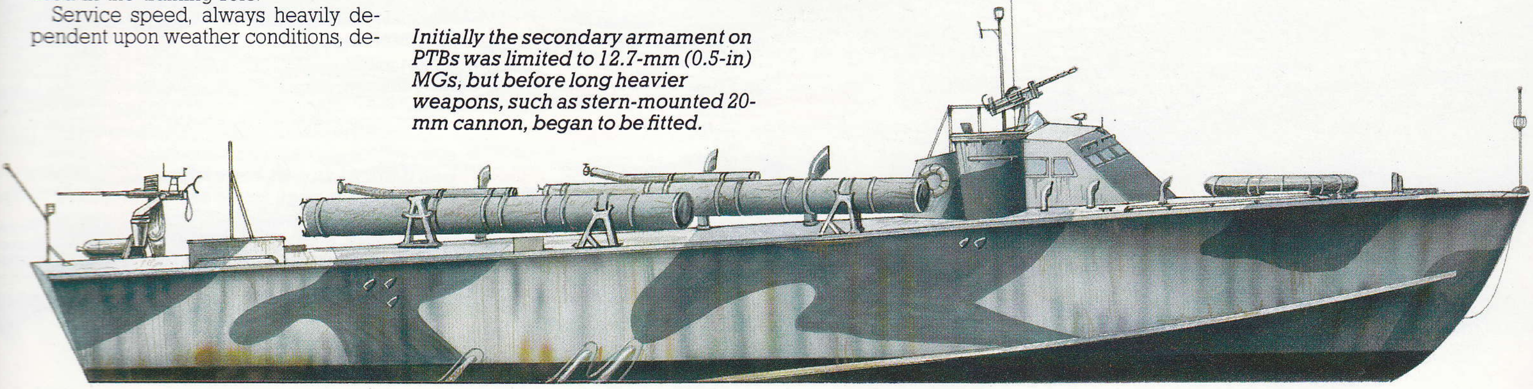
Complement: 17

The Higgins boats (along with the Elco design) bore the brunt of the US PT boat war. At 78 ft (23.77 m), it was also large enough to carry four torpedoes although some were landed later in the war in favour of more guns.

While the activities of the PT boats in the Solomons and the Philippines are well known, it should be remembered that they contributed to campaigns as far apart as those of the Adriatic or (as seen here) around the Aleutians in the Northern Pacific.



Initially the secondary armament on PTBs was limited to 12.7-mm (0.5-in) MGs, but before long heavier weapons, such as stern-mounted 20-mm cannon, began to be fitted.



India

Part 2

The Indian Army

The Indian Army retains many of the traditions that it inherited from the British army when the new Indian Army was formed in 1947. Perhaps the most important of these is that the army remains aloof from the political involvement that has bedevilled so many other nations after emancipation from British rule. Although the army has a policing role within India, its main task is to defend the borders and it has done this on several occasions since 1947, albeit with varying degrees of success. In the years since 1947 the Indian Army has passed through a period of relative neglect, reorganization and re-equipment that has resulted in its now being an efficient and balanced force, but one still reflecting the precarious state of the Indian economy and the fierce social and religious divisions that continue to prevail in modern India.

The Indian Army has seen action since 1947 in a series of 'test matches' with Pakistan and a number of border clashes with China to the north. Internal tribal campaigns and internal insurrections still continue, and United Nations peace-keeping duties will no doubt keep a part of the army in some form or another of active duty for some time to come, so the army's strength of nearly one million volunteers out of a total population of over 745 million is not excessive.

The army is organized into five regional commands. One (the Northern Command) has a headquarters location that has never been disclosed, presumably for security reasons, but the other command locations are as follows: Southern (Poona), Western (Chandi Mandir), Central (Lucknow), and Eastern (Calcutta). Formations are still organized along British lines with divisions, brigades etc., although the caste and social system is still maintained to provide a mixture of 'pure' regiments retaining recruitment from the 'martial races' of India such as the Jats, Sikhs and so on. There are a number of regiments where social and religious distinctions are retained at company levels and there are a few regiments where a mix of races and religions exist.

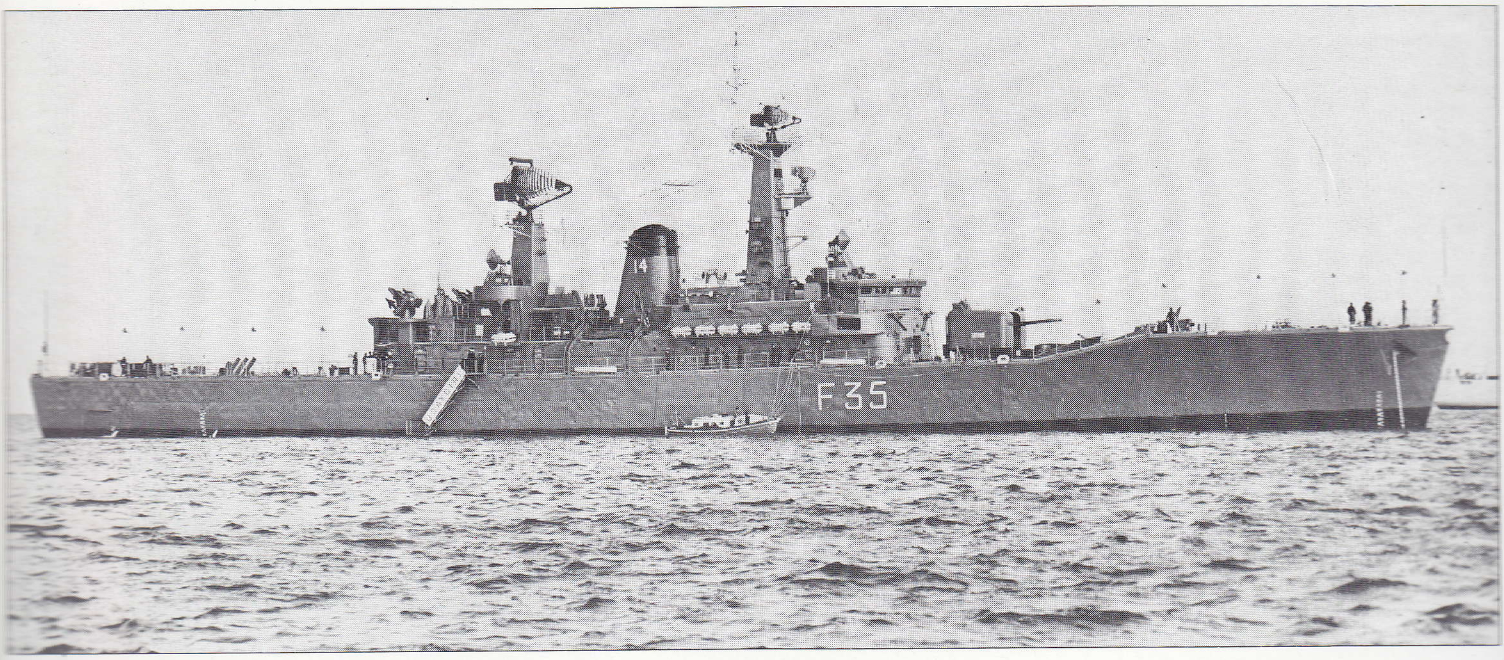
The Indian army remains heavily influenced by British practice, especially in dress and organization, and since partition has been involved in wars with Pakistan and various border clashes with China. Here two soldiers in familiarly British kit use Indian-built L1A1 rifles.

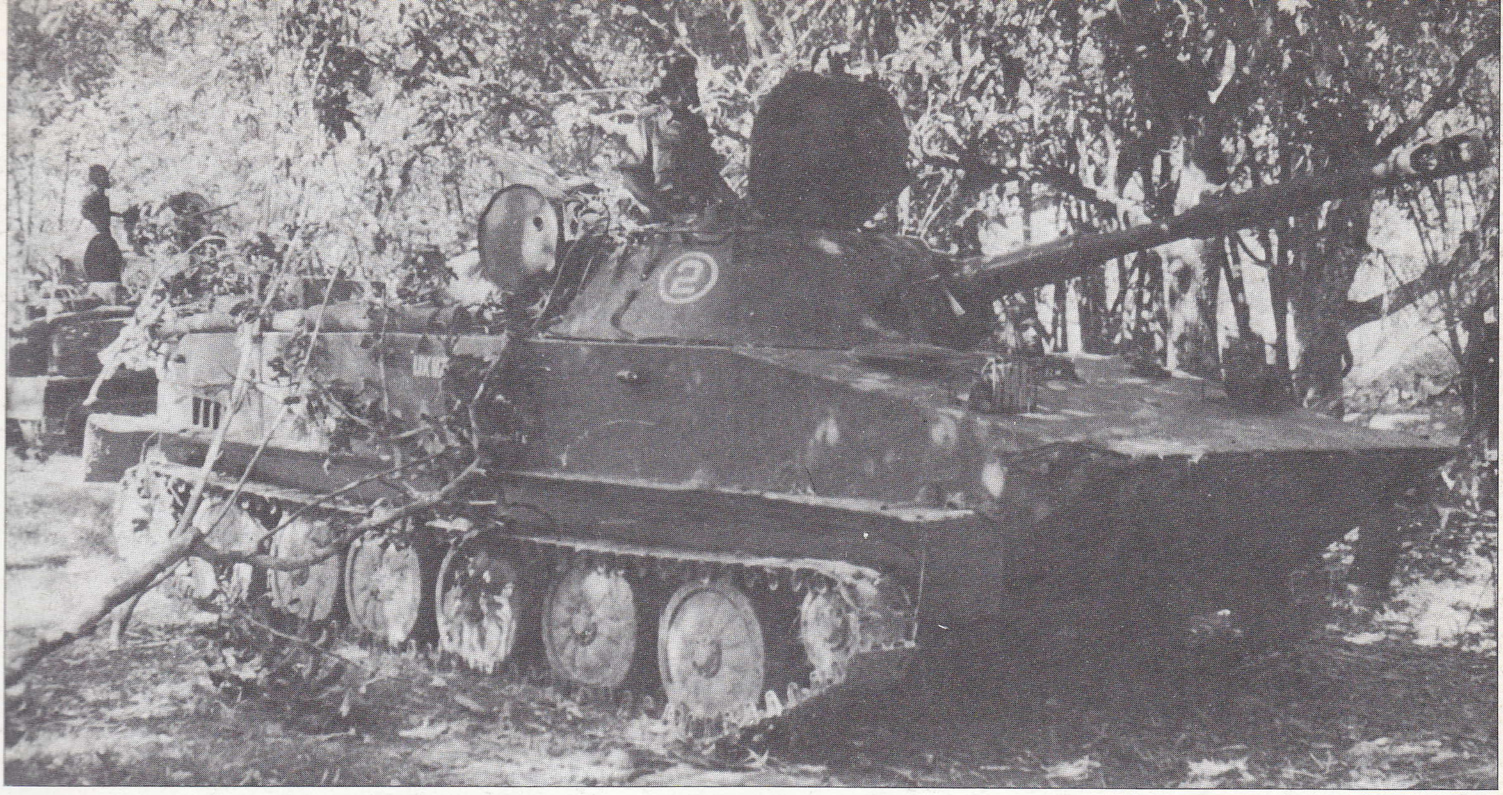
The Indian Army has two armoured divisions, currently being organized on a brigade basis. Most of the tanks used by these armoured divisions comprise 700 Soviet T-54s and T-55s with 300 T-72s in service and more on order. In numerical terms the most widely-used Indian Army tank is the locally-built Vijayanta, of which over 1,900 are in use, but many of these are in the single mechanized division and the five independent armoured brigades. There are 18 infantry divisions, some of them using 750 examples of a wide variety of armoured personnel carriers of Soviet origins (BMP-1, BMP-2, BTR-60 etc.), and following the debacle of the 1962 Himalaya clash with China 10 new mountain divisions have been organized. The infantry formations include a Brigade of Guards and a number of Gurkha regiments. There is also a mixed parachute brigade. Seven independent infantry brigades are in being. Reserves amount to some 200,000.

The Indian Army artillery is organized into 17 independent artillery brigades that include 20 air-defence regiments. The equipment used by these brigades is a very wide mix that ranges from Yugoslav 76-mm (3-in) mountain guns to Soviet S-23 180-mm (7.087-in) long-range guns. Some of the artillery is getting rather old, for ex-British 25-pdr (87.9-mm/3.46-in) gun-howitzers, 139.7-mm (5.5-in) howitzers and 94-mm (3.7-in) anti-aircraft guns are still in use; anti-tank guns still in service include the ex-British 6-pdr (57-mm/2.244-in) from World War II. However, a re-equipment programme is currently under way to replace much of this elderly material, including an international competition to select a new 155-mm (6.1-in) howitzer.

India has a thriving armament industry that has produced much of the army's current equipment, most of it licence-produced in origin. This equipment ranges in scope from the Ishapore-made version of the British/Belgian L1A1/FAL 7.62-mm (0.3-in) rifle up to modern 105-mm (4.13-in) artillery. Vick-

Udaygiri *is one of India's six British 'Leander' class frigates, the first major warships to be built in Indian yards. Similar to the broad-beam 'Leanders', their hangars are enlarged to carry an Aérospatiale Alouette III helicopter, and Dutch radar is fitted.*





A PT-76 Model 2 amphibious light tank of the Indian army is seen in Bangladesh during the Indian invasion of 1971. In addition to her own Vijayanta MBT, India uses Soviet T-54/55s and, now, the T-72.

ers tanks have been locally-produced to form the Vijayanta MBT with its 105-mm main gun, and this basic vehicle has been further locally converted to carry the Soviet M-46 130-mm (5.12-in) long-range gun. Some work has been carried out to produce the Harjron anti-tank missile, but the costs involved have resulted in the purchase of 3,700 Milan missiles. Set against this acquisition must be seen the fact that many Indian Army soldiers are still equipped with the old No. 1 Mk III Lee-Enfield 7.7-mm (0.303-in) bolt-action rifle.

The Indian Army encompasses a number of paramilitary formations such as the Border Security Force (about 85,000 strong), and a number of regional police forces are organized and equipped along army lines and even have a combat function in some border areas. The Ministry of Home Affairs has a 21-battalion strong force known as the Assam Rifles and recruited mainly from Gurkhas.

In the years following Partition, the Indian Army retained its ex-British structure and traditions but coupled them with a switch to the Soviet Union for the bulk of its equipment. Recent years have seen a turning away from this source of equipment supply in order to maintain supplies without too much reliance on a single source. Thus French, Swedish and other sources have been tapped for equipment at one time or another, and at present the United States is emerging as a leading contender for future weapons such as self-propelled artillery and electronics. The main problem for India is defence finance. In its attempt to remain unaligned between the main power blocs the nation cannot expect to receive the military aid provided to neighbours such as Pakistan, and consequently the national budget has to spend some 20 per cent of its expenditure on defence and the army obtains only a share of this.

The Indian Navy

The Indian Navy is the smallest of the Indian defence forces and contains only some 47,000 men. It is, however, one of the most powerful in the region, having as its main strike force eight Soviet 'Foxtrot' class submarines with four more on order. Also on order are four 'Type 209' class submarines from West Germany. There is also an aircraft carrier, the *Vikrant* (ex HMS *Hercules*) operating BAe Sea Harriers and Dassault-Breguet Alizés.

The main surface force consists of three Soviet 'Kashin' class destroyers, with three more on order. The frigate force is sizeable, being formed of 23 vessels, mainly from British origins with some built in Indian yards. The latter includes the six 'Godavari' class frigates that are a local variation on the British 'Leander' class design, of which there are six. The remainder of the frigate force is made up of ex-British designs, some of which are used only for training.

The remainder of the Indian Navy is made up of small craft such as the ex-Soviet 'Osa' class fast attack (missile) and patrol craft. There are 16 of these along with a force of vessels such as small minesweepers, various auxiliary craft and supply vessels.

The main western naval base is at Goa, the southern base is at Cochin, and Vishakapatnam and Port Blair are used in the east.

Indian Navy air service

The sole INAS aircraft-carrier, INS *Vikrant*, was refitted in 1983-4 with a ski-jump for the service's new BAe Sea Harriers. Six single-seat Sea Harrier FRS.Mk 51s and two Harrier T.Mk 60 trainers are now in operation with No. 300 Squadron. A second squadron will be formed when the 10 more single-seaters and two trainers of a supplementary order are delivered.

The Sea Harrier squadron is shore-based at Goa alongside No. 310 Squadron (eight Dassault-Breguet Alizés) and No. 315 Squadron (five Ilyushin Il-38s). Also here are a search-and-rescue unit, No. 321 squadron with Chetaks, and an OCU, No. 551 Squadron with Kirans.

Until three new coastal bases are completed in the late 1980s, the only other INAS base is Cochin. Here, 12 Westland Sea King Mk 42/42As serve with Nos 330 and 336 Squadrons. They deploy to the navy's 'Godavari' class missile frigates and two latest 'Leander' class frigates for ASW operations. Twelve new Sea King Mk 42Bs with Sea Eagle anti-ship missiles will be delivered in 1986. Torpedo-carrying Chetaks from No. 331 Squadron deploy to the older 'Leander' class frigates, and the five Kamov Ka-25 'Hormone' helicopters of No. 333 Squadron are used aboard three Soviet-supplied 'Kashin' class heavy destroyers. The INAS is scheduled to receive 18 Kamov Ka-27 'Helix' helicopters.

Helicopter training is conducted by No. 562 Squadron at Cochin with a few Hughes 300s and Chetaks. Coastal patrol duties have been undertaken by No. 550 Squadron from Cochin with 16 Britten-Norman BN-2B Islanders. However, a new Coast Guard Air Wing has now been set up. It has already received some Chetaks, and will also operate some of the HAL-produced Dornier 228s.

Orders of battle

Indian Army

2 armoured divisions (T-72, T-54, T-55 and Vijayanta)
1 mechanized division (BMP-1, BMP-2, BMD, OT-62, OT-64 and BTR-60)
18 infantry divisions
10 mountain divisions
5 independent armoured brigades
7 independent infantry brigades
1 parachute brigade
17 independent artillery brigades, including 20 air-defence regiments

Indian Navy

Vikrant aircraft-carrier
3 'Kashin II' class destroyers (3 more on order)
23 frigates (4 more on order)
3 'Nanuchka' class corvettes (2 more on order)
16 'Osa' class fast attack craft (missile)
7 large patrol craft
16 minesweepers (6 ocean, 4 coastal and 6 inshore)
10 landing craft (6 LCTs and 4 LCVs, plus 6 more LCTs on order)
8 'Foxtrot' class submarines (4 more on order)
4 'Type 209' class submarines (on order)

Naval Air Force

1 attack squadron with 8 Sea Harrier (12 more on order)
1 anti-submarine squadron with 5 Alizés
2 maritime reconnaissance squadrons with 4 Super Constellations and 3 Il-38 'Mays' (3 more on order)
4 anti-submarine helicopter squadrons with 10 Sea Kings, 5 Ka-25 Hormones and 8 Alouette IIIs (12 more Sea Kings on order)
1 communication squadron with 18 Defenders
1 SAR/liaison helicopter squadron with 10 Alouette IIIs
2 training squadrons with 8 aircraft and 7 helicopters

19 PASS